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**The Lindsaeoid Ferns of the Old World VI
Continental Asia, Japan and Taiwan**

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I. Introduction

The present revision deals with the Lindsaeoid ferns of Asia from India, Nepal, and Ceylon in the West to China, Japan with the Bonin, Volcano, and Ryukyu Islands, and Taiwan in the East; South it covers the parts of Further India not dealt with in *Flora Malesiana*, i.e., Thailand up to the border of Malaya.

Prior to the present author's work the knowledge of the taxonomy of the Lindsaeoid ferns of this region was very uneven. Modern and more or less comprehensive treatments were available for Japan (Tagawa 1937, 1938, supplemented by Iwatsuki 1961; Tagawa 1959; Ohwi 1965), China (Ching 1959), Hainan (Chun, Chang & Chen 1964), Burma (Dickason 1946), and Indo-China (Christensen & Tardieu-Blot 1936, Tardieu-Blot & Christensen 1939). No recent or no complete treatments were available for India and the neighbouring countries, Thailand, and Taiwan.

As shown by the synonymy and citations, the author's views on affinity, classification, and synonymy of the species agree well with those of Tagawa and of Iwatsuki but diverge more or less widely from those of Ohwi, Ching, Tardieu-Blot & Christensen, and Dickason. With regard to Ching's work the author was in a difficult position. It proved impossible to examine his holotypes, or photographs of them, and only in about half of the cases there were isotypes or paratypes available which permitted to establish the identity or affinity of the taxa, or published illustrations which to a certain extent served the same purpose. Judging from the cases where a definite conclusion about Ching's species could be reached, most of them are only extreme forms of other, previously described ones.

Due to the relative scarcity of Chinese material in herbaria outside China, except for a few well explored localities like Hong Kong, the citations for China are consequently very incomplete. For this reason, and because of the fluctuating borders between certain Chinese provinces and the difficulties encountered in attempts to locate all, often equally unstable names of places on maps, Chinese specimens are as a rule only cited by province, although it is realized that this does not give more than a very rough impression of the distribution of the taxa. For India it seems also likely that several species are more widely distributed than is shown by the specimens in the herbaria consulted by the author. It is hoped that additional data will some time in the future be furnished by local workers.

II. Phytogeographic Notes

The assortment of Lindsaeoid ferns in the area under consideration is very unevenly distributed. The main centre of the group being in Malesia, the continental areas of several more or less widespread Malesian species may be regarded as extensions of their Malesian ones, although there is no proof that at least in some cases the converse is not true. In the case of the taxa of section *Synaphlebium* with its strong representation in Malesia and a much weaker one on the continent this may be true, although some endemics do occur in the "continental" part (*L. venusta*, *L. malabarica*, *L. lobata* var. *hainaniana* and var. *epirotas*). Section *Schizoloma*, on the other hand, is so well represented in Continental Asia, especially in Further India and southern Japan, and most species are so much more variable there, that it seems to be the Malesian rather than the continental part of the area that is an extension, or a secondary centre at best. Of the 17 Asiatic species of this section 9 are confined to the continental part, 3 to Malesia (but one extending to Australia), and 5 are common to both areas.

There seems to be two regions in which chiefly Malesian species find their continental limit. One is in the Malay Peninsula (the exact limits are not known due to very incomplete exploration) where *L. integra*, *L. malayensis*, *L. napaea*, *L. parallelogramma*, and *L. doryphora* stop. Another is in the central and eastern Himalayas from Nepal to Assam, where the north-westernmost stations of *L. javanensis*, *L. orbiculata*, and *L. repens* are; the two last-named species extend to Ceylon, *L. orbiculata* even to S. India. There are very few examples of widespread Malesian species reaching further North on the East Asiatic islands but not on the continent: *Tapeinidium pinnatum* (S. Thailand, Philippines; Taiwan and Ryukyu) and *Lindsaea obtusa* (Malaya, Philippines; Taiwan). Three species extend far into China and Japan, viz. *Sphenomeris chinensis*, *Lindsaea odorata*, and *L. lucida*; it would be difficult to decide whether these are originally continental or insular species.

The only examples of notable disjunctions are *L. glandulifera* (Ceylon; East Java and Lesser Sunda Islands), *L. cambodgensis* (Ryukyu; S. Cambodia), and *Tapeinidium pinnatum* (S. India; Malesia, westernmost station in S. Thailand). *L. kawabatae* (Yakushima) and *L. dissectiformis* (Annam and Hainan) form a species pair.

Endemics occur in some concentration in Indo-China, sometimes extending into South China and/or Hainan (*L. austro-sinica*, *L. dissectiformis*, *L. annamensis*, *L. chingii*) and in Ceylon, sometimes extending into South India. (*L. caudata*, *L. venusta*, *L. schizophylla*). Most, if not all, other species described as endemics from South China by Ching are only doubtfully distinct.

The species that occur furthest from tropical Asia and form the outposts of the group as a whole are *L. odorata* (Cheju Dô and Honshu; Nepal) and *Sphenomeris chinensis* (south coast of Korea; mountains of Uttar Pradesh in NW. India). It is not surprising that these are widespread species, either of open habitats or euryoecious.

III. Taxonomy

KEY TO THE GENERA

- (1) Sori on 1-3 (-4) vein-ends; indusium laterally entirely or largely adnate to the lamina; ultimate divisions never dimidiate; veins free; spores monoletate.
- (2) Ultimate free divisions not of a linear- or cuneate-divaricate type, subentire to pinnatifid; sori on the lateral margin of the divisions or in their lobes; pluricellular filiform paraphyses usually (always ?) present 2. **Tapeinidium**
- (2) Ultimate free or nearly free divisions of a linear- or cuneate-divaricate type, with the sorus (sori) on their apical margin; paraphyses 2- or 3-celled, not usually found 1. **Sphenomeris**
- (1) Sori on many vein-ends, or, if on 4 or fewer, the sides of the indusium free, or the pinnules dimidiate, or the veins anastomosing, or these characters combined; spores with few exceptions trilete 3. **Lindsaea**

N.B. In order to avoid redundance, those genera and their subordinate taxa dealt with in the author's treatment of the group in *Flora Malesiana* (1971) are not described in the following.

1. *Sphenomeris*

Maxon J. Wash. Ac. Sc. 3 (1913) 144, nom. cons.; Holttum Rev. Fl. Mal. 2 (1954) 340; Tagawa Col. Ill. Jap. Pterid. (1959) 54, 256; Ohwi Fl. Jap. (1965) 40.

Stenoloma Fée Gen. Fil. (1852) 330, p.p. min.; Beddome Ferns Br. India (1892) 70; Tardieu-Blot & Christensen Fl. Gen. I.-C. 7 (1939) 130, p.p.; Ching Fl. Reip. Pop. Sin. 2 (1959) 275, p.p. mai.; Chun, Chang & Chen Fl. Hain. 1 (1964) 58, p.p.

For further synonymy and description see Fl. Mal. (gen. 1). Eleven species in the tropical and northern subtropical parts of both hemispheres, but wanting in Australia.

KEY TO THE SPECIES*

Rhizome scales up to 5-6-seriate at the gradually broadened base; sori uni- or binerval; larger free ultimate divisions ca. 2 mm wide; lamina subcoriaceous or coriaceous, usually bipinnate & pinnatifid or tripinnate & crenate 1. **Sph. biflora**

Rhizome scales 1-3-seriate (or to 4-seriate at the abruptly broadened base); sori 1-3(-4-) nerval; larger free ultimate divisions 1 mm or more wide, or, if narrower, spathulately broadened at the sorus; lamina herbaceous to subcoriaceous, in full-grown plants bipinnate & bipinnatifid, tripinnate & pinnatifid, or even more dissected 2. **Sph. chinensis**

* For *Sph. gracilis* (Tagawa) Kurata and *Sph. minutula* Kurata see the notes at the end of the genus.

1. **Sphenomeris biflora** (Kaulfuss) Tagawa J. Jap. Bot. 33 (1958) 203; Col. Ill. Jap. Pterid. (1959) 54, 256, fig. 89; Kramer Blumea 15 (1968) 573, 17 (1970) 162. — *Davallia biflora* Kaulfuss Enum. (1824) 221. — *Stenoloma biflorum* (Kaulfuss) Ching Sinensia 3 (1933) 338; Tagawa J. Jap. Bot. 22 (1948) 160; Ching Fl. Reip. Pop. Sin. 2 (1959) 277, pl. 24 fig. 7–9. Type: *Chamisso* s.n., Manila, Luzon (B). — *Davallia tenuifolia* Swartz var. *lata* Hooker ex Moore Ind. Fil. 2 (1861) 301, based on: var. β of Hooker Sp. Fil. 1 (1846) 186, nom. subnud. Lectotype: "Imp. Acad. Petersb." 44, Bonin Is (K.) — *Odontosoria tsoongii* Ching Bull. Fan. Mem. Inst. 1 (1930) 149. Type: several coll. cited, none seen; the collection Tsoong 1423 from the Hailin Is, Kwangtung, China, prob. most eligible as type. — *Stenoloma littorale* Tagawa Acta Phytotax. Geob. 6 (1937) 25. — *Stenoloma chusanum* (L.) Ching var. *littorale* (Tagawa) Ito Bot. Mag. Tokyo 52 (1938) 6. — *Sphenomeris chusana* (L.) Copel. var. *littoralis* (Tagawa) Ito ex Mizushima Misc. Rep. Inst. Natur. Res. 38 (1955) 115 (not seen; quoted by Tagawa 1959, loc. cit.). — *Sphenomeris chinensis* (L.) Maxon var. *littoralis* (err. 'littorale') (Tagawa) Ohwi Fl. Jap. (1965) 40, comb. invalid sine cit. compl. basion. (but possibly validly published elsewhere). TYPE: *Tasiro* s.n., Oshima, Japan (KYO, not seen). — *Sphenomeris* (or *Stenoloma*) *chinensis* or *chusana* of various authors, in part.

For further synonymy and description see Fl. Mal. (gen. 1 sp. 2).

Distribution. Southern Japan, S.E. coast of China, Taiwan, Marianas, northern Philippines.

Ecology. In more or less exposed places, often by the sea, not in forests, at lower and middle elevation.

JAPAN. Honshu: *Yamada* 1525 (GH); *Higuchi* 362 (E, L, U); *Uno* 7941 (GH). — Oshima: *Faurie* 4607 (B); *Kurihara*, *Kurihara* & *Ohba* 3607 (U). — Hachijo Shima: *Suzuki* 391007 (GH). — Shikoku: *Tagawa* 6846 (Pic-Ser), 6859 (E, Pic-Ser, U, US); *Ito* 79 (SING); *Iwatsuki* 600 (US). — Kyushu: *Ichikawa* 200599 (S-PA, W); *Wright* s.n. (GH, K, US). — Koshiki I.: *Hatusima* 16537 (US). — Ryukyu. Yakushima: *Koidzumi* s.n. (MICH, US); *Hatusima* 14871 (US). — Amami-Oshima: *Iwatsuki* 5046 (E, K, L, U); *Hosoyamada* s.n. (US). — Okinawa: *Elliott* & *Nakanyina* 562 (US); *Walker*, *Sonohara*, *Tawada* & *Amano* 6097 (MICH). — Bonin Is.: *Mertens* 68 (L); Acad. Imp. Petersb. 44 (K, lectotype of *Davallia tenuifolia* var. *lata*). — Volcano Is. Iwo Jima: *Porter* 8 (BISH, MICH, US); *Henderson* s.n. (GH).

TAIWAN. *Tanaka* & *Shimada* 13523 (E, GH, SING, S-PA, W); *Oldham* s.n. (GH, S-PA, W); *Faurie* 273 (S-PA), 620 (W). Orchid I., *Huang* & *Kao* 7526 (U).

CHINA. 'Macai Peninsula' (prov.?): *Hance* 12294 (GH). — Fukien: Kuluntu I. near Amoy, *Sampson* s.n. (BM, W). — Taitan I. near Amoy, *Price* 1382 (K). — Kwangtung: Double I. near Swatow, *Dalziel* 67 (BM, E); Swatow, *Dalziel* s.n. (E). — Hong Kong: *Taam* 1695 (L, US); *Matthew* 291 (E); *Hance* 44 (B); *Chan* 84 (K); *Hillebrand* s.n. (S-PA); *Seemann* s.n. (BM); *Walker* s.n. (BM); *Lamont* 1049 A (BM). — 'Yünnan' (corr.??): *Henry* s.n. (BM).

2. **Sphenomeris chinensis** (L.) Maxon J. Wash. Ac. Sc. 3 (1913) 144; Ohwi Fl. Jap. (1965) 40; Kramer Acta Bot. Neerl. 15 (1967) 565; Blumea 15 (1968) 572; Fosberg Taxon 18 (1969) 596; Kramer Blumea 17 (1970) 163. — *Trichomanes chinense* L. Sp. Pl. 2 (1753) 1099. — *Odontosoria chinensis* (L.) J. Smith Bot. Voy. Herald (1857) 430; Nakai J. Coll. Sc. Imp. Un. Tokyo Bot. 31 (1911) 403;

Merrill Lingn. Sc. J. 5 (1927) 12. — *Stenoloma chinense* (L.) Beddome Ferns Br. Ind. (1883) 70. Type: *Osbeck* s.n., China (S-PA). — *Adiantum chusanum* L. Sp. Pl. 2 (1753) 1095. — *Sphenomeris chusana* (L.) Copeland Bull. Bish. Mus. 59 (1929) 69; Tagawa Col. Ill. Jap. Pterid. (1959) 54, 257, fig. 88; Holttum Rev. Fl. Mal. 2 (1954) 341. — *Stenoloma chusanum* (L.) Ching Sinensia 3 (1933) 337; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 130; Ito Fil. Jap. Ill. (1944) pl. 13; Ching Fl. Reip. Pop. Sin. 2 (1959) 275; Chun, Chang & Chen Fl. Hain. 1 (1964) 59. Type: coll.?, China (not seen.). — *Adiantum tenuifolium* Lam. Encycl. 1 (1783) 44. — *Davallia tenuifolia* (Lam.) Swartz Schrad. J. Bot. 1800² (1801) 88; Hope J. Bomb. Nat. Hist. Soc. 13 (1900) 35; Dun & Tutchner Kew Bull. Add. Ser. 10 (1912) 337; Gibbs Common Hongkong Ferns (1927) 8, pl. 4. Type: *Sonnerat* s.n., 'Inde' (P.) — *Hymenophyllum ramosissimum* Ham. ex D. Don Prodr. Fl. Nepal. (1825) 12. Type: *Hamilton* s.n., Nilkantha, Nepal [not seen; this species acc. to Salomon, Nomencl. Gefässkrypt. (1883) 201, and Christensen, Ind. Fil. 1906) 367]

For further synonymy and description see Fl. Mal. (gen. 1 sp. 3).

Distribution. Very widespread in the tropical and northern subtropical parts of the Old World.

Ecology. Terrestrial in open or not too shady places; apparently quite euryoecious.

a. Var. *divaricata* (Christ) Kramer Blumea 15 (1968) 672. — *Odontosoria chinensis* (L.) J. Smith var. *divaricata* Christ Journal de Bot. Sér. 2, II (1909) 23. Type: *Chevallier* 14309, São Tomé (P.) — *Sph. chusana* (L.) Copeland var. *tenuifolia* auct. non (Lam.) Holttum, Rev. Fl. Mal. 2 (1954) 341, fig. 198.

Characterized by the shape of the ultimate segments which are cuneate, abruptly spathulately broadened at the sorus, slightly narrowed at the $\pm$ rounded apex, the apical margin not rarely erose, the sides often corniculate, the base often $\frac{1}{2}$ mm wide, 1–1 $\frac{1}{2}$ mm wide at the sorus; the sori are not rarely paired in a segment, mostly uninerval, or, if binerval, on two connivent vein-ends; spores mostly 55–60 μ long.

This variety is not quite sharply distinct from the following; in its typical form it is widespread, and often much more common than var. *chinensis*, in the larger Malesian Islands. The following more or less typical specimens may be cited from the area of the present revision:

CHINA. Yünnan: *Wang* 76956 (A). — Prov.? *Harland* 43 (E).

INDO-CHINA. Tonkin: *Balansa* 105 (B, K).

THAILAND. *Kerr* 9656 (K, SING).

BURMA. *Kingdon-Ward* 20407 (BM).

SIKKIM. *Hope* (?) s.n. (L).

NEPAL. *Wallich* s.n. (E, K).

INDIA. Assam: *Schiller* 19 (B); *Mann* s.n. (L).

b. Var. *chinensis*

See Fl. Mal. (gen. 1 sp. 3, 3). Segments cuneate, gradually broadened from the base, often about twice as long as wide, the apical margin not or scarcely erose; sori not rarely uninerval but most often bi- or tri-, rarely to quadrinerval, most often $\frac{3}{4}$ –1 $\frac{1}{2}$ mm long. Spores mostly 42–48 μ long.

Distribution. Very widespread, but absent from continental Africa.

Geographically representative or widespread collections:

KOREA. Prov. South Kyōngsang: *Uno* 22953a (GH). — Cheju Dō (Quelpaert I): *Faurie* 92 (B, BM, E, MICH), 2165 (W); *Taquet* 2328 (B, E), 3540 (E, K), 3684 (BM, S-PA).

JAPAN. Honshu: *Tagawa* 7149 (E, GH, K, L, Pic-Ser, U, US); *Togashi* 363 (E, K, L, U); *Ohwi & Okuyama NSM* 191 (B, BM, E, L, S-PA); *Togasi NSM* 433 (B, BM, E, K, L, MICH, S-PA, US) — Kyushu: *Maximowicz* s.n. (BM, SING, S-PA, W); *Schottmüller* 155 (B, S-PA); *Engler* 7171 (B); *Ichikawa* 200140 (GH). — Goto I.: *Warburg* s.n. (B). — Shikoku: *Tagawa* 6862 (US); *Beattie & Kurihara* 10135 (US); *Faurie* 4610 (B). — Hachijo Jima: *Oldham* 108 (GH). — Nakashima: *Schwarz* 162 (Pic-Ser). — Oshima: *Faurie* 4607 (B); *Kurihara, Kurihara & Ohba* 361 (U). — Ryukyu, Yakushima: *Furuse* s.n. (TOFO). Amami Oshima: *Iwatsuki* 4927 (E, K, L, U). Iheya: *Suzuki* s.n. (US). Okinawa: *Field & Loew* 23 h (SING); *Walker, Sonohara, Tawada & Amano* 6052 (K, MICH, US); *Conover* 948, 971, 1013, 1799 (US). Iriomote: *Nishida* 653 (US); *Walker & Tawada* 6745 (US). Yaeyama Retto: *Unger's coll.* 8 (B).

TAIWAN: *Tanaka & Shimada* 13523 (BM, L, MICH, US); *Gressitt* 221 (B, BM, K, S-PA, U); *Faurie* 620 (B, BM, W); *Warburg* 9477 (B, E), 9584, 10924 (B).

CHINA. Kiangsu: *Chavel* 596 (E). — Anhwei: *Ching* 8743 (GH, US). — Hupeh: *Wilson* 2663 (B, BM, E, HBG, K, US, W); *Henry* 4373 (B, BM, US). — Chekiang: *Ching* 1370 (B, BO, E, US), 1816 (BO, E, GH, K, US); *Steward* 2375 (E, K, US); *Chiao* 14104 (K, US), 14543 (BRI, SING, US). — Kiangsi: *Schindler* 375 (B, BM, E, K, W); *Handel-Mazzetti* 213 (W). — Hunan: *Fan & Li* 12 (BO, L, W), 685 (A, BO, L); *Tsang* 23756 (A, L). — Szechuan: *Chow* 4668 (E, US); *Fang* 2108 (E, GH, K, US), 3818, 4671 (E, K), 5795 (E, GH, K, US), 9931 (E, SING); *Wilson* 5307 (BM). — Kweichow: *Cavalerie* 1373 (E); *Tsiang* 6256 (GH); *DeVol* 563 (GH). — Fukien: *Chung* 2137 (BO, K), 2857 (E, GH, K, W); *Tang* 6916 (BM, MICH), 7101 (SING, S-PA); *Norton* 1081, 1082 1083, 1084 (US); *Metcalf & Tang* 543 (US), 6097 (BM). — Kwangtung: *Tsang* 16574 (S-PA, US), 20001 (K, MICH), 20579 (BO, K, MICH, W), 20708 (B, BO, K, L, MICH, SING, W), 21243 (A, K, MICH, S-PA), 26201 (A, MICH); *Lau* 684 (GH, MICH), 20135 (K, US); *Levine* 511 (BO, GH); *Gressitt* 1235, 1314 (BM, E). — Kwangsi: *Tsang* 23069 (GH), 28175 (A, SING, US). — Yünnan: *Rock* 7698 (GH, K, US); *Wang* 66809, 71825, 71871, 71962, 73922, 74146, 77198 (A); *Handel-Mazzetti* 5935 (K, US, W); *Forrest* 18840 (BM, E, K), 26019 (E, K); *Henry* 9018 A (E, K, US); *Cavalerie* 1373, 4023 (E, K); *Maire* 2744 (E, K). — Tibet: *Ludlow, Sheriff & Taylor* 6728 (BM, MICH). — Hainan: *Tsang* 16778 (B, BO, K, US); *Gressitt* 1030 (E, GH); *Eryl Smith* 1452 (BM, K), 1453 (K, SING, S-PA, US). — Hong Kong: *Fortune* 16 (B, E, L); *Taam* 1336 (US), 1448 (BO, US), 2023 (MICH, US); *Jelinek* 31 (B, W); *Palmer & Bryant* 41 (US); *Eryl Smith* 1456 (SING). — Macau: *Warburg* 5490 (B).

INDO-CHINA. Tonkin: *Tsang* 27256, 30152 (K); *Chevalier* 29327, 29495 (SING). — Laos: *Poilane* 16926 (K). — Annam: *Clemens* 3565 (BM, U); *Poilane* 1617 (K, SING). — Cochinchina: *Gaudichaud* s.n. (B).

THAILAND. *Eryl Smith* 585 (BM, K, SING), 398, 1214, 2292 (K); *Smitinand* 417 (K); *Tagawa, Iwatsuki & Fukuoka T* 588 (L, U), *T* 1273 (U).

BURMA. *Dickason* 6721 (A, E), 9105 (A, E, L); *Rock* 2078 (US), 2152 (S-PA, US); *Forrest* 52394 (K); *McKee* 6018 (BM).

BANGLA DESH. Wallich s.n. (K).

BHUTAN. Griffith s.n. (B, K).

SIKKIM. Meebold 2224 (B); Hope s.n. (K, L, US); Gamble 7019 (K); Hooker s.n. (GH, B); Engler 3543 (B).

NEPAL. Stainton, Sykes & Williams 5189 (BM, E, GH, Pic-Ser), 8917 (BM, E); Fleming 893, 905, 915 (BM).

INDIA. Assam: Mann s.n. (BO, E, HBG, L, SING, S-PA, US); Schlagintweit s.n. (B, BM, S-PA); Hooker & Thomson s.n. (B, BM, E, GH, K, S-PA, U, W); Watt 10322 (L, US); N.E.F.A., Panigrahi 17045 (K). — Manipur: Watt 6050 (B, E). — West Bengal: Schelpe 3670 (BM); Bir s.n. (U, US); Warburg 989 (B); Gamble 6856 A, 7325 (K), 7307 (E, K). — Bihar: Haines 652 (K); Mooney 138 (K). — Uttar Pradesh: Kumaon, Strachey & Winterbottom 2 (BM, GH, K); Stewart 320 (BM). — Himachal Pradesh: Bliss 95, 168 (K); Trotter 255 (K). — Orissa: Mooney 695, 3869 (K). — Pondicherry: Perrottet 591 (B, L), 1397 (B). — Madhya Pradesh: Mooney 1296 (K). — Madras: Perrottet 591, 1171, 1172 (W); Bourne 4843, 4998, 5139 (K); Hohenacker-exsicc. 1260 (B, BM, E, L, S-PA, W); Thomson s.n. (B, BM, E, MICH, SING, S-PA, U, US, W); Hügel 3176 (W); Engler 3636, 3641 (B). — Mysore: Meebold 9621 (B); Blanford s.n. (US). — Kerala: Wallich '245' (US).

CEYLON; Thwaites CP 983 (B, BM, BO, E, SING, S-PA, W); Pfaltzer & Abeyguna Wardena 35 (U); Freeman 17, 42 (BM); Gardner 20 (W); Schmid 1039 (BM); Naylor Beckett 202 (B, E, K).

Not seen from the Andaman and Nicobar Islands.

DOUBTFUL AND INSUFFICIENTLY KNOWN SPECIES

Sphenomeris gracilis (Tagawa) Kurata J. Geob. 13 (1965) 101. — *Stenoloma gracile* Tagawa Acta Phytotax, Geob. 6 (1937) 227. Type: Koidzumi s.n., Iriomote, Ryukyu (KYO, not seen); one other collection cited from the same island.

No authentic material seen. Judging from the description it seems to fall within the variability of *Sph. chinensis*, except for the arrangement of the leaves with are described as subremote. The author compared it with *Stenoloma eberhardtii*, in the present author's opinion a *Lindsaea* (*L. dissectiformis*, see below), but the description of the scales of *St. gracile* shows that it is a *Sphenomeris* and not related to the group of *L. dissectiformis*.

Sphenomeris minutula Kurata J. Geob. 13 (1965) 101. Type: M. Satô 4243, Amami Oshima, Ryukyu (TOFO, not seen).

The original description, in a journal which is perhaps not very widespread, is as follows:

Rhizoma repens, ca. 1 mm crassum, squamis setaceis fuscobrunneis cylindricis articulatis ca. 1 mm longis dense obiectum; frondibus subremotis. Stipites straminei deorsum subcastanei, glabri, graciles, 5-10 mm longi, supra sulcati. Lamina ovata vel oblongo-ovata, apice in ambitu obtusa, 1-1.5 cm longa, 0.7-1 cm lata, bipinnata vel tripinnatifida, chartacea, utrinque glabra; rachi gracili leviter flexuosa; pinnis 2-4 jugis, ascendentibus, alternatis, inferioribus oblique flabelliformibus, usque ad 5 mm longis 5 mm latis, costis supra late sulcatis, segmentis ultimis cuneatis apice dilatatis truncatis, 1.5-2 mm longis 0.5-1 mm latis, venulis in segmentis ultimis 1-2. Sori marginales, indusii submembranaceis subintegris, pallide griseis [sic] interdum brunnescentibus, ca. 0.5 mm longis, 0.3-0.9 mm latis... This is the tiniest species of the genus *Sphenomeris*. Notwithstanding the minuteness, it abundantly produces perfectly developed sori on the terminal margin of ultimate lobes...

Through Prof. Kurata's courtesy a specimen identified by him as belonging to this species was deposited in the Utrecht herbarium: Sako 5214, Amami Oshima. I am not satisfied that it is specifically distinct from *Sph. chinensis*, nor can I at present decide its status. It may be a juvenile, yet fertile form of that species; the specimens were collected on mossy rocks, like *L. odorata* var. *japonica*, which I think is also a permanently (phenotypically or genotypically ?) juvenile form.

2. Tapeinidium

(Presl) C. Christensen Ind. Fil. (1906) 631; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 133; Ching Fl. Reip. Pop. Sin. 2 (1959) 278; Kramer Blumea 15 (1968) 545.

For further synonymy and description see Fl. Mal. (gen. 2).

A genus of seventeen species, almost confined to the Malesian-Melanesian area.

KEY TO THE SPECIES

- (1) Petiole, at least in the upper part, and rachis dark, pale-angled 1. **T. gracile**

 (1) Petiole concolorous, usually quite pale.
 (2) Lamina pinnate & pinnatifid or more dissected 2. **T. luzonicum**
 (2) Lamina simply pinnate, with serrate or crenate pinnae 3. **T. pinnatum**

1. **Tapeinidium gracile** (Blume) v.A.v.R. Handb. (1909) 315; Kramer Blumea 15 (1968) 551. — *Davallia gracilis* Blume En. Pl. Jav. (1828) 233. Type: *Blume 1731* or s.n., Java (L). — ? *Tapeinidium lineare* (Cav.) C. Chr. Dansk Bot. Ark. 9 (1937) 26; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 133. — *Dicksonia linearis* Cavanilles Descr. (1802) 274. Type: *Née* s.n., Philippines (MA, not seen; photogr. in U).

For notes on the synonymy see Kramer, loc. cit., and for the description Fl. Mal. (gen. 2 sp. 8).

A West Malesian species extending to the Moluccas, known from the present area by two collections.

TAIWAN. Orchid I, *Huang & Kao* 7525 (U).

INDO-CHINA. Annam: Nhatrang, *Poilane* 3400 (BM, K, P).

2. **Tapeinidium luzonicum** (Hooker) Kramer Blumea 15 (1968) 552. — *Davallia luzonica* Hooker Sp. Fil. 1 (1846) 174, pl. 60 B 2, 3, 5. Type: *Cuming* 139, Luzon (isotypes B, L). — *T. biserratum* auct. non (Blume) v.A.v.R.; Holttum Rev. Fl. Mal. 2 (1954) 339, fig. 197.

For further synonymy and description see Fl. Mal. (gen. 2 sp. 11).

A West and Central Malesian species recently collected in southern Peninsular Thailand.

THAILAND. Tagawa, *Iwatsuki & Fukuoka* T 4830 (U, US).

3. **Tapeinidium pinnatum** (Cav.) C. Christensen Ind. Fil. (1906) 631; Ogata Ic. Fil. Jap. 1 (1928) pl. 44; Ito Fil. Jap. Ill. (1944) pl. 15; Holttum Rev. Fl. Mal. 2 (1954) 339, fig. 196; Ching Fl. Reip. Pop. Sin. 2 (1959) 278, pl. 25 fig. 7-11; Kramer Blumea 15 (1968) 553. — *Davallia pinnata* Cavanilles Descr. (1802) 277; Hooker Sp. Fil. 1 (1846) 173, pl. 60 B. Type: *Née* s.n., Philippines (MA, not seen; photogr. U).

For further synonymy and description see Fl. Mal. (gen. 2 sp. 12).

Western and Central Malesia, extending sporadically to Continental Asia and Japan. Reports from elsewhere are due to confusion with other species.

JAPAN. Ryukyu: Okinawa, *Amano* 6297 (US). Ishigaki, *Masamune & Suzuki* s.n. (US); *Tagawa & Iwatsuki* 4480 (US); *Nishida* 447 (US); *Fosberg* 37391 (L, US). Iriomote, *Tagawa & Iwatsuki* 4566 (K, L, U, US), 4657 (US); *Walker & Tawada* 6705 (BISH, K, MICH, US); *Ogata* 273 (BM); *Oka* 13751 (TOFO).

TAIWAN. *Tagawa* 990 (K).

THAILAND. *Eryl Smith* 1656 (BM), 1566, 1912, 1913, 2190 (K); *Marcan* 1241 (SING), 1332 (BM, SING); *Kerr* 6803, 9299 (K); *Smitinand* 2164 (K); *Murton* 8 (K).

INDIA. Kerala: Palghat Hills, Gen. *Johnston* s.n. (K).

The single old collection from India, which I did not find cited in the literature, and the absence of the species from Ceylon are quite remarkable.

3. *Lindsaea*

Dryander in J. E. Smith Mém. Ac. Turin 5 (1793) 401; Trans. Linn. Soc. 3 (1797) 39; Beddome Ferns S. India (1863/64; 1873) 39; Handb. Ferns Br. India (1892) 72; Tagawa Acta Phytotax. Geob. 6 (1937) 24; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 118; Holttum Rev. Fl. Mal. 2 (1954) 321; Ching Fl. Reip. Pop. Sin. 2 (1959) 257; Tagawa Col. Ill. Jap. Pteridoph. (1959) 52, 226; Ohwi Fl. Jap. (1965) 39; Kramer Blumea 15 (1968) 557. — *Schizoloma* Gaudichaud Ann. Sc. Nat. 3 (1824) 507; p.p.; Beddome loc. cit. (1863/64, 1873) 9; loc. cit. (1892) 77, p.p.; Tardieu-Blot & Christensen loc. cit. (1939) 128; Holttum loc. cit. (1954) 342; Ching loc. cit. (1959) 272. — *Stenoloma* Fée sensu Tardieu-Blot & Christensen loc. cit. (1939) 130, p.p.; Ching loc. cit. (1959) 275 p.p.

For further synonymy and description see Fl. Mal. (gen 4).

About 150 species, pantropic and subtropic. For the subdivision of the genus see Kramer (1968, loc. cit. and Fl. Mal.).

KEY TO THE SPECIES*

- (1) Lamina bipinnate, the secondary rachises at least in the adaxial groove with short pubescence (SECT. *Aulacolindsaea*) 25. ***L. caudata***
- (1) Secondary rachis glabrous; or lamina not bipinnate.
 - (2) Rhizome epiphytic, long-scandent, with broad, triangular scales and strongly dorsiventral stele; leaves remote (SUBGEN. *Odontoloma*).
 - (3) Lamina of full-grown plants bipinnate 35. ***L. parasitica***
 - (3) Lamina simply pinnate.
 - (4) Sori continuous; rhizome scales chocolate brown 34. ***L. oblanceolata***
 - (4) Sori interrupted; rhizome scales golden brown.
 - (5) At least some of the fertile lobes of the pinnules erose-denticulate 33. ***L. merrillii***
 - (5) Fully fertile lobes of pinnules not erose-denticulate.

* The reader is reminded that in the present author's terminology the term *pinnule* always designates a free ultimate segment, regardless of the degree of dissection of the lamina.

- (6) Larger pinnules 10–12 mm long; pinnules incised to $\frac{1}{3}$ or $\frac{1}{2}$, the lobes evenly narrowed from base to apex 31. **L. glandulifera**
- (6) Larger pinnules 15 mm or more long, with truncate lobes, much less deeply incised, the lobes about parallel-sided 32. **L. repens**
- (2) Rhizome terrestrial, mostly short-creeping and with clustered leaves, rarely more long-creeping and with remote leaves, but then the scales narrow; stele radially symmetric or nearly so (SUBGEN. **Lindsaea**).
- (7) Lamina bipinnate or more dissected, with gradually reduced upper (primary) pinnae; or at least the basal pinnules of the almost conform terminal pinna enlarged, lobed (SECT. **Schizoloma**). (p. 12)
- (8) Veins scantily to freely anastomosing 13. **L. heterophylla**
- (8) Veins quite free.
- (9) Pinnules not or hardly dimidiate, deeply incised, consisting of cuneate or flabellate, $\pm$ divaricate lobes.
- (10) Rhizome not very short-creeping, the petioles not clustered, several mm apart; sori various.
- (11) Sori on 1 or 2 veins; all ultimate lobes linear-cuneate 11. **L. schizophylla**
- (11) Sori rarely on 1, mostly on 2–5 veins; very few or no ultimate lobes linear-cuneate 12. **L. cambodgensis**
- (10) Rhizome very short-creeping, with clustered petioles; sori uni- to quadrinerval.
- (12) The greater part of the lamina fully tripinnate; ultimate lobes abruptly spatulately broadened at the sorus, there much broader than the wings that connect them 1. **L. dissectiformis**
- (12) Lamina fully tripinnate only at the base; ultimate lobes gradually broadened to the sorus, there not much wider than the wings connecting them, or scarcely broadened.
- (13) Sori on 1 or 2 veins; larger ultimate lobes 1 mm wide at the apex (fig. 4) 2. **L. kawabatae**
- (13) Sori on 1–4 veins; larger ultimate lobes 3–5 mm wide at the apex (fig. 5) 3. **L. annamensis**
- (9) Pinnules distinctly dimidiate, or, if only indistinctly or not at all so, not deeply dissected into cuneate or flabellate lobes.
- (14) Larger, dimidiate pinnules incised to the middle or beyond, the lobes not broadened at the sorus and not apiculate see 10.
- (14) Larger, dimidiate pinnules incised to $\frac{1}{3}$, occasionally to the middle; some or most lobes broadened at the sorus and apiculate (fig. 6) 9. **L. chingii**

- (14) Larger, dimidiate pinnules not or much more shallowly incised.
- (15) Petiole and basal half of the primary rachis abaxially terete (**fig. 9**) 7. **L. austro-sinica**
- (15) Petiole and basal half of the rachis abaxially bi-angular, often pale-margined.
- (16) Sori strongly interrupted, even though the incisions of the margin do not, or some just barely, reach the level of the receptacle; indusium reaching and often here and there surpassing the margin; receptacle sometimes seemingly decurrent onto some of the veins supporting it; texture often subcoriaceous 6. **L. repanda**
- (16) Sori less strongly interrupted, or some or all incisions reaching to beyond the receptacle, or the indusium remote from the margin.
- (17) Lamina simply pinnate, with suborbicular-flabellate, scarcely or not incised larger pinnules, or bipinnate, the unipinnate apical portion relatively very long, at the base with suborbicular-flabellate pinnules 5. **L. orbiculata**
- (17) Pinnules not suborbicular-flabellate, or, if some approach this shape, the lamina bipinnate with the unipinnate leaf-apex relatively less predominant.
- (18) Terminal pinnule of lateral pinnae very large, asymmetrically deltoid, much larger than any of the (paucijugate) lateral pinnules of the same pinna 8. **L. javanensis**
- (18) Terminal pinnule or segment of lateral pinnae lanceolate, rhombic, subelliptic, or, if deltoid, in size comparable to the larger lateral pinnules in the same pinna; or lamina simply pinnate.
- (19) Pinnules in the basal portion of the simply pinnate leaf-apex (but above those that are transitional in shape between pinnate pinnae and non-pinnate pinnules) rhombic, with $\pm$ protracted apex, their sori broken by incisions reaching considerably beyond the receptacle.

- (20) Terminal pinnule/segment large, well-developed, free or nearly so; no upper pinnules of lateral pinnae (if any) so strongly reduced as to be denticuliform; indusium mostly close to the margin; lamina not rarely unipinnate 8. **L. javanensis**
- (20) Terminal segment narrowly triangular, in lateral pinnae (if any) mostly at the base confluent with some denticuliform reduced upper pinnules; pinnule-lobes (except sometimes the outer ones) with little or not convex outer margin; indusium strongly intramarginal; rarely unipinnate (fig. 7) 4. **L. chienii**
- (20) Terminal segment as in the preceding species; lobes of fertile pinnules convex on the outer margin; indusium almost or quite reaching the margin; bipinnate, rarely more dissected 10. **L. bouillodii**
- (19) Pinnules in the basal portion of the leaf-apex (but above those that are transitional from pinnate pinnae to non-pinnate pinnules) parallelogrammoid, rectangular, or flabellate, not rhombic with protracted apex, their sori continuous or with very few incisions that scarcely reach beyond the receptacle or do not reach its level (fig. 8) 5. **L. orbiculata**
- (7) Lamina simple, simply pinnate, or, if bipinnate, without gradual transition from pinnae to pinnules, and with conform terminal pinna without larger, lobed basal pinnules.

- (21) Lamina simply pinnate (rarely simple), with non-dimidiolate, lanceolate or linear pinnules, with conform terminal one, and reticulate venation 14. **L. ensifolia**
- (21) Lamina simply pinnate, with lanceolate pinnules, without free conform terminal one, and with irregularly reticulate venation 13. **L. heterophylla**
- (21) Lamina simply pinnate with free veins or bipinnate with dimidiolate pinnules, or simply pinnate with reticulate veins and dimidiolate pinnules.
 - (22) Veins sparingly to copiously anastomosing (SECT. Synaphlebium). (p. 15)
 - (23) Veins of larger fertile pinnules irregularly anastomosing, sometimes in some of the pinnules nearly or quite free.
 - (24) Sori continuous, or, if interrupted, the incisions not deeper than 1 mm.
 - (25) Sori continuous or interrupted; pinnules 10–12 mm long, 3–4 mm wide; petiole pale, abaxially flat or convex, bi-angular, the angles evanescent downward; sterile pinnules broadly crenate-sinuate 16 **L. napaea**
 - (25) Sori interrupted; pinnules 10–20 mm long, 4–6 mm wide; petiole pale, abaxially angular to the base, sulcate at least near the apex; sterile pinnules bicrenate 15. **L. malayensis**
 - (24) Sori interrupted, the larger incisions 2 mm deep or more 17. **L. malabarica**
- (23) Veins of larger fertile pinnules regularly anastomosing, at least in the basal $\frac{2}{3}$.
 - (26) Sori of larger, fully fertile pinnules continuous.
 - (27) Pinnules twice as long as wide; petiole usually reddish brown 21. **L. integra**
 - (27) Pinnules $2\frac{1}{2}$ –3 × as long as wide; petiole stramineous 20. **L. cultrata**
 - (26) Sori of larger, fully fertile pinnules interrupted by incisions of the margin.
 - (28) Incisions of pinnules going to or slightly beyond the level of the receptacle; outer or all sori short, on 1–3 vein-ends; indusium falling short of the margin by less than its width to slightly surpassing it (fig. 2) 23. **L. venusta**

- (28) At least most incisions of the pinnules deeper; sori usually on more than 3 veins, and/or the indusium more strongly intramarginal.
- (29) Pinnules opaque, hardly narrowed to the obliquely truncate apex; outer margin distinct, with an incision; pinnae rather abruptly narrowed below the $\pm$ caudate, pinnatifid apex; pinnule-bearing rachises abaxially brown, sulcate and pale-margined 19. **L. parallelogramma**
- (29) Pinnules with subacute or rounded apex and/or distinctly narrowed to the apex; or, if truncate, the outer margin not incised; pinnules often translucent; pinnae more gradually narrowed; pinnule-bearing rachises various.
- (30) All pinnule lobes and receptacles distinctly convex towards the margin; indusium reaching to the margin or nearly so (**fig. 1**) 22. **L. lobata**
- (30) These characters not combined, at least the inner pinnule lobes with straight outer margin.
- (31) Pinnules with a distinct outer margin joining the upper at an angle of less than 90° , its sorus sometimes continuous with that of the upper; at least the inner incisions reaching considerably beyond the level of the receptacle 20. **L. cultrata**
- (31) Pinnules without a distinct outer margin, this rounded into the upper; most or all incisions reaching considerably beyond the level of the receptacle 18. **L. obtusa**
- (31) Pinnules without a distinct outer margin, this rounded into the upper; incisions reaching to the level of the receptacle, or shallower 16. **L. napaea**

(22) Veins quite free.

(32) Pinnules not dimidiate.

(33) Pinnules at least $6 \times$ as long as wide; rachis dark-sclerotic, abaxially terete.

(34) Pinnules articulate at their insertion 29. **L. divergens**

(34) Pinnules not articulate at their insertion ... 28. **L. walkerae**

(33) Pinnules relatively much shorter; rachis abaxially bi-angular, dark or not. *see* 7 (SECT. **Schizoloma**).

(32) Pinnules dimidiate.

(35) Rachis abaxially terete, except near the apex.

(36) Pinnules incised, or, if entire, less than 12 mm long; simply pinnate; spores monolete.

(37) Pinnules herbaceous to subcoriaceous, without a distinct outer margin; rachis not dark-sclerotic 26. **L. odorata**

(37) Pinnules subcoriaceous or coriaceous, with a distinct outer margin; at least the basal half of the rachis dark-sclerotic (**fig. 3**) 27. **L. himalaica**

(36) Pinnules entire (except if incompletely fertile), usually 15–20 (–35) mm long; spores trilete; simply pinnate or bipinnate 24. **L. doryphora**

(35) Rachis abaxially bi-angular.

(38) Pinnules erose; indusium 0.5 mm wide 5. **L. orbiculata**

(38) Pinnules not erose; indusium narrower.

(39) Lamina simply pinnate, with reduced and somewhat remote basal pinnules; most incisions of the pinnules reaching to about the level of the receptacle ... 30. **L. lucida**

(39) Lamina bipinnate, or, if simply pinnate, the basal pinnules not reduced and little or not remote; incisions of pinnules reaching considerably beyond the level of the receptacle ... 17. **L. malabarica**

SECTION *Schizoloma* (Gaud.) Kramer

1. *Lindsaea dissectiformis* Ching Sinensia 1 (1930) 52. Type: *McClure 18312*, Hung Mo Shan, Hainan (isotype A). — *Odontosoria eberhardtii* Christ Journal de Bot. 21 (1908) 235, 266, nom. nud.; Merrill Lingn. Sc. J. 5 (1927) 12. — *Stenoloma eberhardtii* Ching Sinensia 3 (1933) 338; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 132, fig. 16 1/2; Ching Fl. Reip. Pop. Sin. 2 (1959) 277, pl. 24 fig. 1/2; Chun, Chang & Chen Fl. Hain. 1 (1964) 58, fig. 26. — *Lindsaea eberhardtii* Kramer Acta Bot. Neerl. 6 (1957) 135. Type: *Eberhardt 115, 116*, Annam (P).

Rhizome very short-creeping, 1–1½ mm in diam.; scales castaneous, very narrowly triangular, the cell partitions laterally somewhat protruding, almost the whole apical half uniseriate, to 6-seriate at the base, to 2½ mm long. Leaves clustered; petioles ca. 10–25 cm long, slightly exceeding the lamina to 1½ × as long, castaneous to atropurpureous, scarcely lustrous, quadrangular with subterete base, upward pale-margined. Lamina deltoid to oblong, acute, ca. 8–15 cm long, at the base tri- or quadripinnate & pinnatifid, upward gradually of simpler structure, with up to 10 primary pinnae to a side that are more than once pinnate & pinnatifid; colour dark or olivaceous green when dry, texture herbaceous. Primary rachis like the petiole, upward gradually stramineous. Primary pinnae slightly ascending, contiguous, the largest (basal) ones 4–7 cm long, 2½–3½ cm wide; upper pinnae gradually shorter; at least the basal pinnae distinctly inequilateral, basally broader; secondary rachises abaxially narrowly sulcate, bi-angular at the base, upward gradually green-marginate. Secondary pinnae up to 10 to a side, slightly ascending. Penultimate divisions ascending, variously once or twice bifid, the ultimate lobes obcuneate-spathulate, uni- or the largest binerval, 3–5 mm long if almost free, the base ca. 0.4–0.5 mm wide, upward gradually cuneately, then at the sorus abruptly spathulate-broadened, there ½–1½ mm wide, their apices triangular-acute, obliquely truncate, or rarely rounded, in addition erose-denticulate. Upper lobes/segments gradually confluent into pinnatifid pinna-apices. Sterile segments narrower, lanceolate, acute. Veins immersed, scarcely evident. Sori uni- or less often binerval; indusium pale, ½–2 mm long, not rarely not at right angles with its vein, its base straight or faintly concave or convex, laterally free, its outer edge sinuate-erose, 0.4–0.5 mm wide, not reaching the margin by an equal or often considerably larger distance, rarely by only about half its width. Spores light yellowish brown, trilete, verruculose, ca. 27 µ.

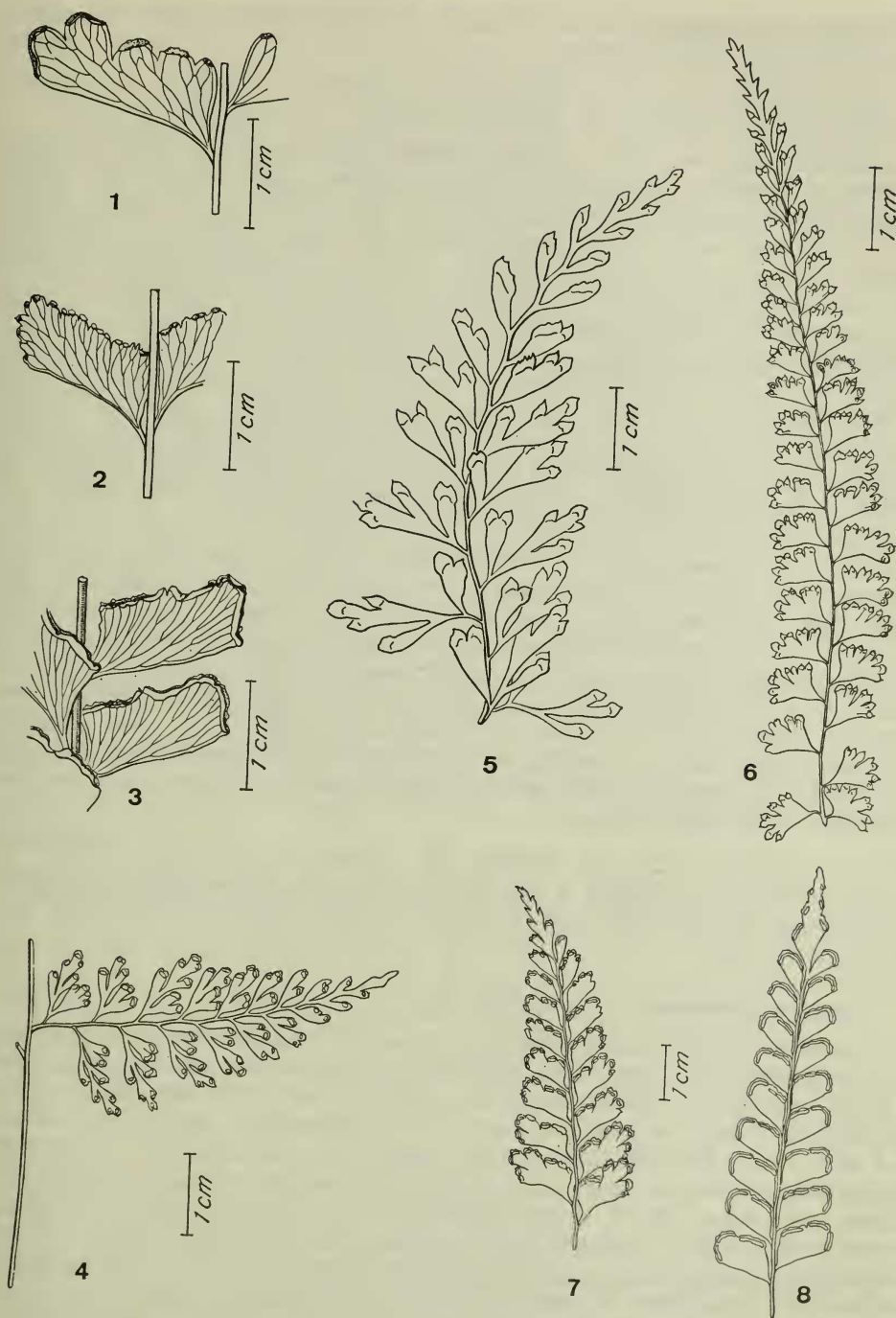
Ecology: In moist forests. ca. 1500 m alt.; very few data.

Distribution: Confined to Annam (Central Viet-Nâm) and Hainan.

INDO-CHINA. Annam: *Eberhardt 115, 116* (P, type of *S. eberhardtii*); *Poilane 3692* (BM, BO, K, MICH), *4156* (SING), *4360* (K, P), *22047* (GH); *Jacquet s.n.* (BO, P).

CHINA. Hainan: *Eryl Smith 1457* (BM, K); *McClure 778* (Lingnan Univ. 18312) (A, isotype).

Notes. Closely related to the Japanese *L. kawabatae* and the Madagascan *L. millefolium*; see also Kramer (1957, loc. cit.). The basionym of *Stenoloma eberhardtii*, the name most often used for this species, was published as a nomen nudum and the first description did not appear until 1939 in the Flore Générale de l'Indo-Chine. Therefore Ching's name *L. dissectiformis* takes precedence.



Figs. 1-8. LINDSAEA

1. *Lindsaea lobata* var. *hainaniana*. Detail of pinna (Liang 63789, US). 2. *L. venusta*. Detail of pinna (Wall 20.37, GH). 3. *L. himalaica*. Detail of pinna (Griffith s.n., Assam, K). 4. *L. kawabatae*. Basal pinna (holotype KYO). 5. *L. annamensis*. Lower pinna (Poilane 3567, P). 6. *L. chingii*. Basal pinna (Tsang 29330, P). 7. *L. chienii*. Lamina apex (Kurata s.n., Honshu, TOFO). 8. *L. orbiculata* var. *commixta*. Lamina apex (Kawabata 807, TOFO).

2. ***Lindsaea kawabatae*** Kurata J. Geobot. 13 (1965) 100. — Type: *Kawabata 991*, Yakushima, Japan (TOFO). **Fig. 4**

As the journal in which this species was described is not likely to be found in many smaller libraries, the original description is here quoted verbatim.

Rhizoma breviter repens, squamis minutis lineari-lanceolatis dilute castaneis obtectum; frondibus approximatis. Stipites graciles, usque ad 14 cm longi, rufo-castanei vel sursum brunneo-straminei, quadrangulares, supra sulcati. Lamina 8–11 cm longa, basi 5–9 cm lata, deltoidea vel ovata, acuminata, tripinnata sursum bipinnata vel simpliciter pinnata; pinnis ca 10-jugis, erecto-patentibus, breviter petiolatis, alternatis vel inferioribus suboppositis, inferioribus inter se 1–2 cm remotis, deltoideo-lanceolatis, acuminatis; pinnulis 5–7 jugis, distincte anadromice dispositis, infimis posterioribus longioribus, subdimidiato-lanceolatis, ad 1.2 cm longis 5 mm latis, pinnatis, segmentis 2–3-jugis, anguste cuneatis ad 3 mm longis, ad 1.5 mm latis, apice acute denticulatis, segmentis infimis anterioribus flabellato-cuneatis, pauci-incisis, pinnulis superioribus et anterioribus omnibus dimidiato-rhomboides vel oblique flabellato-cuneatis, venulis in segmentis ultimis 1–2; textura herbacea, viridi. Sorus unus pro lobulo ultimo, venas 1–2 occupans, indusio griceo [sic] e margine magis remoto.

To this good description the following points may be added: Major, bipinnate pinnae 3 to a side, the upper ones very gradually of simpler structure, the uppermost confluent into a pinnatifid leaf-apex. Primary rachis abaxially bi-angular like the petiole; secondary rachises abaxially narrowly sulcate, narrowly green-marginate. Ultimate divisions apically erose or denticulate, the narrower with convex outer margin, the broader ones sometimes subtruncate. Sori $\frac{1}{3}$ –1 mm long, the longer ones basally concave; indusium pale, delicate, $\pm$ erose, laterally free, 0.3–0.4 mm wide, not reaching the margin by an approximately equal distance, not reflexed at maturity. Spores as in *L. chienii*, q.v. Only known from the type collection; no ecological data.

Notes. As already noted by Kurata, this species is very closely related to *L. dissectiformis* ("*eberhardtii*"), with which it shares i.a. the inequilateral, basitonic basal pinnae. For the differences see the key; more material may show the two species to be one.

3. ***Lindsaea annamensis*** Kramer, spec. nov.

Fig. 5

Rhizoma breviter repens, squamis ferrugineis, angustissime triangularibus, acuminatissimis obtectum. Folia approximata; petiolus badius, quadrangularis. Lamina triangularis, basi bipinnata et pinnatifida vel tripinnata, chartacea vel subcoriacea. Pinnae majores pro latere 6–10, adscendentes, triangulares, acutae vel acuminatae. Pinnulae majores pro latere 3–6, adscendentes, $\pm$ profunde pinnatifidae, acroscopice segmentis 1–3, basiscopice segmento unico vel nullo; lobi ultimi valde adscendentes, cuneato-flabellati, majores bifidi, minores simplices, usque ad 8×5 mm, basi ca 1 mm lati, apice eroso-denticulati. Apices laminae pinnarumque sensim angustati et structura simpliciore, pinnatifidi; saepe acuminati vel caudati. Venae binae ad quaternae vel in lobis minoribus singulae. Sori venis 1–4 insidentes, majores basi saepe concavi. Indusium marginem non attingens. Sporae tetraëdriceae.

Rhizome short-creeping, ca. $2\frac{1}{2}$ mm in diam.; scales reddish brown, very narrowly acuminate-triangular, with a considerable uniseriate apical portion, to 6-seriate at the base, to $2\frac{1}{2}$ mm long. Leaves close; petioles castaneous, somewhat shining, quadrangular, upward $\pm$ pale-margined, adaxially sulcate, 10–30 cm long,

equaling to almost twice as long as the lamina. Lamina ca 10–22 cm long, triangular, bipinnate & pinnatifid at the base, or in large leaves there tripinnate and otherwise bipinnate & pinnatifid; colour medium green or olivaceous when dry, texture chartaceous to subcoriaceous. Rachis like the upper part of the petiole, upward gradually green. Major pinnae 6–10 to a side, (subfalcately) ascending, contiguous, triangular, acute or acuminate, subsessile, to 8×3 cm; secondary rachises stramineous, abaxially shallowly sulcate, upward gradually narrowly green-marginate. Pinnules ascending, $\pm$ contiguous, 3–6 larger ones to a side; larger pinnules asymmetrically ovate to trapeziform in outline, ca. $15\text{--}20 \times 5\text{--}7$ mm, $\pm$ deeply pinnatifid, with 1–3 segments on the acroscopic side, the largest also with one on the basiscopic side, in the largest incised to a narrow costal wing; basal pinnae sometimes with 1 or a few basiscopic fully pinnate & pinnatifid pinnules. Ultimate lobes strongly ascending, cuneate-flabellate, the larger ones bifid, the smaller ones entire, the largest ca 8×5 mm, ca 1 mm wide at the base, the apical margin protracted into 1 or several apiculi separated by incisions, or in broader lobes coarsely erose. Upper pinnae, pinnules, etc., gradually and strongly reduced, confluent into narrow, lobed, lanceolate, often acuminate or caudate lamina and pinna apices. Veins immersed, evident, 2–4 per lobe, single in the smallest. Sori on 1–4 vein-ends, usually basally concave if long; receptacle often laterally exceeding its veins, not rarely not at right angles with them; indusium delicate, pale, subtentive to erose, laterally free, $\frac{1}{2}$ mm wide, falling short of the margin by an at least equal, often larger distance. Spores medium brown, trilete, slightly verruculose, ca. $25\text{--}28 \mu$.

Type and only known collection: *Poilane 3567*, Nhatrang, Annam, Viet-Nam (P, 2 sheets), on poor sandy soil in forest, 1800 m. “Bia di” (Mois).

Note. This species combines characters of *L. chingii*, *L. dissectiformis*, and *L. chienii* but is probably closest to the last-named species. Its spores seem to be normally developed, but it might, of course, still have originally arisen by hybridization.

4. ***Lindsaea chienii*** Ching *Sinensia* 1 (1929) 4; Hu & Ching *Il. Fil. Sin.* 1 (1930) pl. 19; Tagawa *Acta Phytotax. Geob.* 6 (1937) 34, fig. 3 A-C; Col. Ill. *Jap. Pterid.* (1959) 53, 226, fig. 86; Ching *Fl. Reip. Pop. Sin.* 2 (1959) 270; Kurata, Satake & Mashiko *Pterid. Idzu Penins.* (1960) 23, map II. — *L. tenera* Dryander var. *chienii* (Ching) Tardieu-Blot & Christensen *Fl. Gén. I.-C.* 7 (1939) 127; Iwatsuki *Acta Phytotax. Geob.* 19 (1961) 5. — *L. orbiculata* (Lam.) Mett. ex Kuhn var. *chienii* (Ching) Ohwi *Fl. Jap. Pteridoph.* (1957) 35 (not seen). — *Schizoloma chienii* (Ching) Tardieu-Blot *Am. Fern J.* 48 (1958) 34. Type: Ching 7184, Yao-mar Shan, N.W. Kwangsi, China (isotype US). — *L. orbiculata* auct. non (Lam.) Mett. ex Kuhn; Ito *Il. Jap. Pterid.* (1944) pl. 20; Ohwi *Fl. Jap.* (1965) 40, p.p. **Fig. 7**

Rhizome short- to very short-creeping, $1\frac{1}{2}\text{--}2$ mm in diam.; scales castaneous, narrowly lanceolate, the upper $\frac{1}{2}$ or $\frac{2}{3}$ uniseriate, up to 3-seriate at the base but some entirely uniseriate, to ca. $1\frac{1}{3}$ mm long. Leaves clustered to a few mm apart; petioles reddish brown to castaneous, lustrous, slender, upward gradually quadrangular with narrow, pale edges, not or only adaxially sulcate, ca. 10–30 cm long, equaling the lamina to almost twice as long. Lamina herbaceous or firmly herbaceous, dark green when dry, especially above, ca. 10–20 cm long, bipinnate, or tripinnate at the extreme base, deltoid, oblong (or rarely linear and simply pinnate in juvenile but already fertile plants), with 1–6 pairs of major (fully pinnate) pinnae to a side, without a conform terminal one; rachis like the upper part of the petiole, upward gradually entirely pale. Pinnae narrowly

triangular, acute or shortly acuminate, very shortly petiolulate to subsessile, the lower ones about their width apart but ascending and therefore often $\pm$ contiguous, the larger ones 5–10 cm long, 2–3 cm wide; secondary rachises pale to greenish, abaxially flat or narrowly sulcate, at least above narrowly alate. Lower pinnae with ca. 4–8 free pinnules to a side; pinnules ascending or the basal ones spreading, of variable size and shape, depending on the place in the lamina, the larger ones of basal pinnae in outline $\frac{1}{4}$ -elliptic, rhombic, or trapeziform, strongly dimidiate, often ca. 8×4 – 12×6 mm, obtuse, incised, with 1–3 oblique incisions on the upper and 1 or 2 on the outer side, these very oblique, of very unequal depth, the basal pinnules often deeply pinnatifid, with a few very unequal segments on the anterior side, or less often fully pinnate, with a few flabellate pinnules on both sides. Upper pinnules of lower pinnae and many or all of upper pinnae cuneate-flabellate, gradually reduced to the pinna-apex, some confluent with it, or sometimes, especially in larger pinnae, the pinna-apex basally pinnatifid but $\pm$ distinct, rhombic to lanceolate, of variable size, acute or shortly acuminate, $\pm$ distinctly serrato-lobate or basally pinnatifid, in size comparable to the larger pinnules of the pinna or larger. Basal acroscopic pinnule cuneate-flabellate. A few upper pinnae pinnatifid or only basally pinnate, transitional to the non-pinnate pinnules in the base of the pinna-apex, these rhombic or trapezoidal, with several incisions that go well beyond the receptacle, none, or only the uppermost that are already connected with the pinnatifid leaf-apex not incised and with continuous sori. Veins immersed, scarcely evident except in transmittent light, once or twice, rarely 3 $\times$, forked, $\frac{1}{2}$ – $\frac{2}{3}$ mm apart, a costa scarcely or not developed. Incisions of the margin acute, the lobes with parallel, straight or slightly convex-convergent sides, their outer margin straight or convex in outer lobes, distinctly erose, usually also slightly crispate; dimensions of lobes very variable. Sterile pinnules sharply dentate; sterile leaves of simpler structure sometimes present with the fertile ones but much less regularly so than in *L. orbiculata*. Sori extending to the terminal segments, interrupted by the incisions of the margin, of variable length, often 1–3 mm long and on 2–5 vein-ends (rarely uninerval), strongly intramarginal, with straight or, especially in outer lobes and smaller pinnules, basally concave receptacle; indusium pale to brownish, $\pm$ erose and/or crispate, 0.4–0.5 mm wide, not reaching the margin by an equal or larger (rarely smaller) distance, not reflexed at maturity. Spores light yellowish brown, trilete, verruculose, ca. 25 μ .

Ecology. In shaded places, on rich soil, mostly at lower elevations but in the tropics to above 1000 m. Apparently not rare in Japan.

Distribution. See below.

Geographically selected citations:

JAPAN. Honshu: Tagawa Fl. Jap. 6199 (US); Kurata 82, 1175a (TOFO). — Shikoku: Inada 4194 (TOFO). — Kyushu: Otomasu 4928 (TOFO); Kurata 8875 (TOFO). — Hachijo Jima: Sakurai s.n. (B, E). — Ryukyu: Yakushima, Iwatsuki 3427 (E, K, L, U, US); Arakane 136 (KYO); Hamaya 2784 (TOFO). Amami Oshima, Hutch 21015 (TOFO). Tokara Gunto (Linschoten Is), Kawagoe s.n. (US). Okinawa, Sonohara, Tawada & Amano 6293 (BISH, K, MICH, US); Conover 960, 1134, 1757 (US). Ishigaki, Oka 14720 (TOFO); Hatusima 22917 (TAI).

TAIWAN. Ogata 190 (BM); Hancock 71 (K); Suzuki 7442 (TAI); DeVol c.s. 4475 (TAI).

CHINA. Kwangsi: Ching 7184 (US, isotype). — Hainan: Eryl Smith 1478 (K, SING). — Also reported from Kwangtung and Yunnan by Ching (1959).

INDO-CHINA. Annam: *Chevalier* 30685 (K, MICH, P).

THAILAND. *Hennipman* 3937 (L); *Tagawa, Iwatsuki & Fukuoka* T 1259 (L), T 4808 (L, U, US).

Notes. The isotype seen by the author is less incised than most other specimens but otherwise not atypical.

L. chienii is very closely related to, and probably to a certain degree inter-fertile with, *L. orbiculata* var. *commixta*. There are a few intermediates, but relatively so few that *L. chienii* is treated here as a distinct species.

5. ***Lindsaea orbiculata*** (Lamarck) Mett. ex Kuhn Miq. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 279; Merrill Lingn. Sc. J. 5 (1927) 13; Ogata Ic. Fil. Jap. 1 (1928) pl. 34; Tagawa Acta Phytotax. Geob. 6 (1937) 33; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 125; Ching Fl. Reip. Pop. Sin. 2 (1959) 264; Chun, Chang & Chen Fl. Hain. 1 (1964) 54; Iwatsuki Acta Phytotax. Geob. 19 (1961) 8; Ohwi Fl. Jap. (1965) 40, p.p. — *Adiantum orbiculatum* Lamarck Encycl. 1 (1783) 41. Type: *Sonnerat* s.n., Malacca (P). — *L. flabellulata* Dryander Trans. Linn. Soc. 3 (1797) 41, pl. 8 fig. 2; Beddome Ferns S. India (1864/65) 72, pl. 216 (poor); Dunn & Tutchner Kew Bull. Add. Ser. 10 (1912) 337; Gibbs Common Hongkong Ferns (1927) 10, pl. 15. Lectotype: *Nelson* s.n., Macao (BM). — *L. longipes* Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 125, fig. 15. Type: *Poilane* 8208, Ninh-Hoa, Annam (P, 2 sh.; dupl. in BM, K). — ? *L. simulans* Ching Fl. Reip. Pop. Sin. 2 (1959) 265, 371, nom. invalid. (see notes at the end of the genus).

For further synonymy and description see Fl. Mal. (sp. 3).

KEY TO THE VARIETIES

Plants usually (always ?) with simply pinnate sterile leaves beside the fertile ones; fertile leaves simply pinnate, or, if bipinnate, at least some pinnules at the base of the terminal pinna, above the uppermost pinnate pinnae, suborbicular; the lamina not gradually passing from the bipinnate condition at the base to the simply pinnate apex but with a rather abrupt transition var. *orbiculata*
Sterile simply pinnate leaves usually wanting; no pinnules suborbicular; larger laminae upward gradually of simpler structure, with a gradual transition from the bipinnate base to the simply pinnate apex. var. *commixta*

a. Var. ***orbiculata***

Distribution. As given below, and extending to the Philippines and Java.

Geographically selected citations:

JAPAN. Shikoku: *Okamura* s.n. (GH). — Ryukyu: Amami Oshima, *Tokashiki* s.n. (TOFO); *Hutch* 21150 (TOFO). Yoronjima, *Ugehara* s.n. (US). Okino Erabu, *Tagawa & Iwatsuki* 2118 (E, K, L, U, US), 2157 (US); *Hatusima & Sako* 21402, 21507 (TOFO). Okinawa, *Teruya* 168 (SING); *Walker* 5923a (BISH, K, US).

TAIWAN. *Tanaka & Shimada* 13522 (BM, E, GH, L, MICH, SING, S-PA, US, W, Z); *Hancock* 70 (BM, K, US); *Faurie* 619 (B, BM, W); *Ream* 477 (GH, MICH); *DeVol & Huang* 1213 (TAI, US); *Kao* 3485 (TAI).

CHINA. Hunan: *Fan & Li* 355 (A, BO, L, W). — Fukien: *Tang S. G.* 7065 (BM, S-PA); *Schindler* 421 (B, BM, E, K). — Kwangsi: *Morse* 47 (US); *Tsang* 24497 (A, MICH). — Kweichow: *Cavalerie* 3563 (E). — Kwangtung: *Tsang* 21753 (A, BO, E, K, L, MICH, W, Z); Canton Chr. College 12201 (E, US); *Delavay* s.n. (P). — Hainan: *Eryl Smith* 1465 (BM, K, SING, US, p.p.); Mrs. *Hancock* 70, 71 (US); *Lau* 1491, 4950 (MICH). — Prov.?: *Osbeck* s.n. (S-PA); *Meyen* s.n. (B). — Hong Kong: many coll., e.g. *Eryl Smith* 1468 (K, SING); *Matthew* 308, 309 (E); *Taam* 1415 (US), 1882 (MICH, US); *Faurie* 15762 (E); *Wright* s.n. (GH, K, US). — Macau: *Nelson* s.n. (BM, lectotype of *L. flabellulata*). — Reported from Szechuan and Yunnan by Ching (1959); no material seen.

INDO-CHINA. Tonkin: *Tsang* 30149 (A, E, K), 30752 (A, K). — Annam: *Squires* 344 (BO, BRI, E, SING, W); *Pételot* 3424, 3511 (P, US); *Poillane* 1094 (K, MICH, P), 2698 (GH, HBG, MICH, P), 5242 (GH, MICH, P), 8208 (BM, K, P, type of *L. longipes*). — Cochinchina: *Gaudichaud* s.n. (B, K).

THAILAND. *Marcan* 1228 (BM, SING); *Kerr* 2179 (BM K).

BURMA. Reported by Dickason (1946), no material seen.

INDIA. Assam: *Clarke* 45642 A, B (K). — Kerala: *Ferguson* ? (BM).

b. Var. **commixta** (Tagawa) Kramer Fl. Mal. II 1, 3 (1971) 207. — *Lindsaea commixta* Tagawa Acta Phytotax. Geob. 6 (1937) 37, fig. 3 H-J; Ching Fl. Reip. Pop. Sin. 2 (1959) 268; Tagawa Col. III. Jap. Pterid. (1959) 54, 226, fig. 87. — *L. tenera* Dryander var. *commixta* (Tagawa) Iwatsuki Acta Phytotax. Geob. 19 (1961) 6. Type: *Hidaka* s.n., Tanage-Shima, Kyushu (KYO, not seen; fotogr. in U). — *L. bonii* Christ Not. Syst. 1 (1910) 187. Type: *Bon* 8, S. Tonkin (P). — *L. hainanensis* Ching Bul. Fan Mem. Inst. Biol. N.S. 1 (1949) 298; Acta Phytotax. Sin. 8 (1959) 141, fig. 16; Fl. Reip. Pop. Sin. 2 (1959) 267; Chun, Chang & Chen Fl. Hain. 1 (1964) 54. Type: *Lau* 6149, Hainan (A, MICH, isotypes). — *L. tenera* auct. non Dryander; Beddome Ferns S. India (1863/64, 1873) 7, pl. 24. **Fig. 8**

For further synonymy and description see Fl. Mal. loc. cit.

Distribution. See below; sporadically extending to Malesia.

JAPAN. Kyushu: Koshiki Jima, *Ohyo* 8913 (KYO, paratype). — Ryukyu: Tanegashima, *Tasiro* s.n. (KYO, paratype). Yakushima, *Ohtani* E.12 (U); *Ohba* 662674 (US); *Kawanabe* 5346 (TOFO); *Hutch* 19108 (TOFO); *Kawabata* 807, 808 (TOFO); *Kudo* s.n. (KYO, paratype). Nakanoshima, *Hatusima* 15720 (US). Amami Oshima, *Faurie* 4599 (B, KYO, W, paratypes; p.p., with *L. chienii*); *Hutch* 21018, 21639, 21704 (TOFO); *Koidzumi* s.n. (KYO, paratype). Okinawa, *Walker* c.s. 6086 (US); *Teruya* 98, 166, 167 (SING); *Ito* s.n. (KYO, paratype); *Sonohara*, *Tawada & Amano* 6294 (MICH, US); *Conover* 978, 1056, 1070, 1757, 1800 (US); *Ogata* 191 (BM). Ishigaki, *Oka* 13348 (TOFO); *Kawagoe* s.n. (US). Iriomote, *Nishida* 542 (US); *Warburg* s.n. (B). Yonaguni, *Koidzumi* s.n. (KYO, paratype).

TAIWAN. *Sagae* s.n. (TOFO); *Hancock* 71 (US); *Ito* s.n. (KYO, paratype); *Huang* 1052 (TAI); *Murphy* s.n. (K); Botel Tobago, *Chuang & Hsu* 2448 (TAI); Orchid I., *Huang & Kao* 7534 (TAI, U).

CHINA. Hainan: *Lau* 6149 (A, MICH, isotypes of *L. hainanensis*), 1491 (GH); *Tsang & Fung* L. U. 18141 (GH, K); *Eryl Smith* 1465 (BM, p.p.). — Hong Kong: *Lorrain* 18 (K, p.p.).

INDO-CHINA. Tonkin: *Bon* 8 (P, type of *L. bonii*). — Annam: *Evrard* 1280 (MICH, P); *Hayata* 582 (P); *Chevalier* 30640 (P); *Cadière* 48 [68] (BM). — Cambodia: *Bouillod* 59 (P). Cochinchina: *Gaudichaud* s.n. (B).

THAILAND. *Tagawa, Iwatsuki & Fukuoka* T 1259 (US), T 637, 7153 (L, U, US); *Tagawa* T 3939 (L, U, US); *Sørensen, Larsen & Hansen* 2269 (E).

BURMA. *Lace* 4746 (E).

NEPAL. *Ghose* 10 (P).

INDIA. Assam: *Godwin Austen* s.n. (P); *Clarke* 45642 A, B (K); *Wenger* 15, 169 (K). — Uttar Pradesh: *Fleming* 864 (BM). — Kerala: coll.? (BM).

CEYLON. *Thwaites* CP 3311 (B, BM, BO, E, K, P, SING, W), CP 1381 (B, BM, BO, E, GH, K, L, P, SING, W); *Wall* s.n. (B, E, GH, K, P, US); *Walker* s.n. (B, E, GH, P, S-PA, U, W); *Sledge* 1381 (K, U); *Hutchison* s.n. (E).

Notes. Many, not all, Ceylonese specimens have longer rhizomes, narrower terminal segments, and more interrupted sori than typical specimens. This is presumably due to introgression by *L. schizophylla*.

As stated under *L. chienii*, there are some intermediates between that species and *L. orbiculata* var. *commixta* which may be of hybrid origin, e.g., *Ohtani* s.n. from Yakushima (U). They have more strongly intramarginal and interrupted sori and more incised subapical pinnules than typical var. *commixta*. On the other hand, the number of intermediates between var. *commixta* and var. *orbiculata* is considerably larger, and the differences between the two are more gradual and not very easy to define. Therefore the two are treated as varieties of one species, whereas *L. chienii* is retained as specifically distinct.

The type collection of *L. hainanensis* consists of large, atypical plants with an almost conform terminal pinna, but in the absence of further material they do not seem to represent more than an extreme form of var. *commixta*, typical specimens of which have also been collected in Hainan.

6. ***Lindsaea repanda*** Kunze Bot. Zeit. 6 (1848) 541; Tagawa Acta Phytotax. Geob. 6 (1937) 38, fig. 4 A — C. Type: Mertens s.n., Bonin Is. (LE; dupl. in L).

Rhizome short-creeping, ca. 2 mm in diam.; scales castaneous, very narrowly triangular, about the apical $\frac{1}{3}$ uniseriate, to ca. 5-seriate at the base, to ca. $1\frac{1}{2}$ mm long. Leaves close to clustered; petioles quadrangular almost to the base, medium or more often dark brown to blackish or adaxially paler, abaxially the greater part pale-angled and scarcely sulcate, ca. 8—22 cm long, equaling to almost twice as long as the lamina. Lamina olivaceous to brownish when dry, herbaceous or usually subcoriaceous, ca. 8—13 cm long, bipinnate or subbipinnate, rarely almost simply pinnate when fertile, with 1—6 well-developed pinnae to a side, rarely only the basal divisions subpinnate; no conform terminal pinna present. Primary rachis like the petiole, abaxially largely or entirely dark and pale-angled. Pinnae subsessile, spreading to ascending, the larger ones ($1\frac{1}{2}$ –) 3—5 cm long, $\frac{3}{4}$ — $1\frac{1}{2}$ cm wide; secondary rachises pale, abaxially bi-angular to sulcate. Pinnules of well-developed pinnae 3—7 to a side, $\pm$ narrowly and asymmetrically obovate to flabellate-subrhombic, not very distinctly dimidiate, cuneate at the base, sessile, $\pm$ contiguous; larger fertile ones ca. 6—10 mm long, 5—6 mm wide; pinnules of small pinnae and of the leaf-apex trapezoid, distinctly dimidiate, to 12 x 6 (–10) mm. Upper pinnules of lateral pinnae and of the leaf-apex

somewhat reduced, more narrowly cuneate, none or 1 or 2 connected with the relatively large, rhombic to lanceolate, often lobed, obtuse to shortly acuminate terminal segment (pinnule); upper (primary) pinnae rather abruptly reduced, some transitional between pinnae and pinnules, $\pm$ pinnatifid, very obtuse. Veins immersed, not evident, free, 1 — 3 x forked, close, $\frac{1}{2}$ — $\frac{2}{3}$ mm apart. Upper/outer margin of sterile pinnules coarsely erose-denticulate or more often irregularly and sharply dentate; this margin in fertile pinnules with a few irregular, shallow incisions ca. $\frac{1}{2}$ mm deep, otherwise erose or not rarely sharply erose-denticulate. Sori on the upper/outer margin, strongly interrupted even by quite shallow incisions, on (1 —) 2—5 vein-ends, basally not rarely concave, their interior edge usually irregular, seemingly slightly decurrent onto the apices of the veins supporting them (see Tagawa's figures); indusium pale, rigid, 0.4—0.5 mm wide, its edge erose-denticulate, reaching, and, with its small lobes mostly here and there slightly exceeding the margin, scarcely bulging at maturity. Spores yellowish, trilete, verruculose, ca. 27 μ .

Ecology. No data extant.

Distribution. Confined to the Bonin Is.

JAPAN. Bonin Is: Hahashima, *Hisauchi* s.n. (KYO); *Tuyama* s.n. (KYO). Ootoshima, *Tuyama* s.n. (KYO). Chichishima, *Tuyama* s.n. (KYO). Island?, *Hattori* 272 (P); *Mertens* s.n. (L,LE, type); *Toshima* s.n. (KYO); *Warburg* s.n. (B); Imp. Acad. Petersb. 43 (K, isotype ??).

Notes. A distinct species but evidently quite close to *L. orbiculata* var. *commixta*. Among the species with sufficiently known range this is perhaps the most narrowly distributed.

7. ***Lindsaea austro-sinica*** Ching Bull. Fan Mem. Inst. Biol. N.S. 1 (1949) 297; Fl. Reip. Pop. Sin. 2 (1959) 266. Type: *Tsang* 22638, Shang-sze Hsien, Kwangsi, China (GH, P, Pic-Ser, isotypes). — *L. scandens* auct. non Hooker; Tardieu-Blot & Christensen Fl. Gen I.-C. 7 (1939) 121, p.p.mai — *L. longipes* Tardieu-Blot & Christensen. loc. cit. 125, quoad specim. citat., p.p., excl. typ. **Fig.9**

Rhizome rather short- to short-creeping, 2—4 mm in diam.; scales reddish brown, very narrowly triangular, the apical $\frac{1}{2}$ or $\frac{1}{3}$ uniseriate, up to 4-seriate at the base, to 2 $\frac{1}{3}$ mm long. Leaves close to a few mm apart; petioles lustrous, castaneous to blackish, abaxially entirely terete and concolorous, adaxially sulcate and upward usually narrowly pale-margined, 15—40 cm long, about equaling to 1 $\frac{1}{2}$ x as long as the lamina. Lamina oblong, ca. 15—35 cm long, medium to dark or olivaceous green when dry, herbaceous or chartaceous, bipinnate (rarely tripinnate at the base), with 1 — 7, mostly 3 — 5 pinnae to a side, the terminal pinna almost conform or passing rather abruptly into the bipinnate part; primary rachis like the petiole or upward paler and $\pm$ sulcate, sometimes the uppermost part pale-margined. Pinnae very narrowly triangular, shortly acuminate, or in small leaves oblong and acute or obtuse, often distinctly petiolulate, 6—13 cm long, 2 $\frac{1}{2}$ —4 cm wide, relatively broadest in paucijugate leaves, 1 $\frac{1}{2}$ —5 x as long as wide, ascending, several cm apart but sometimes contiguous through being ascending, with 2—13 pinnules to a side, the basal posterior pinnule of the lowermost pinnae sometimes pinnate.

a few cm long, and a few pinnules next to it pinnatifid; secondary rachises abruptly pale at their insertion, stramineous to pale brown, or the basal ones of large leaves basally concolorous, abaxially terete at the base, upward gradually biangular, sometimes shallowly sulcate, near the apex narrowly green-margined. Pinnules less than half their width apart to contiguous, spreading or somewhat ascending, dimidiate, otherwise variable in shape, the larger ones of paucijugate, usually small laminas rhombic or subrectangular, 12—20 mm long, 9—15 mm wide, less than $1\frac{1}{2}$ x as long as wide, often widest at the base, often with one incision a few mm deep in the upper and another in the outer margin, the lobes separated by them $\pm$ convex; in plurijugate, mostly larger laminas, and upper pinnules of some paucijugate ones, rounded-rectangular to ligulate (resembling those of *L. lancea* and *L. doryphora*), 11—14 mm long, 6—7 mm wide, $1\frac{1}{2}$ —2 x as long as wide, scarcely narrowed to the apex, the upper margin rounded into the outer, the larger pinnules with 1 or 2 incisions up to $\frac{1}{2}$ mm deep in the upper and one in the outer margin, the smaller ones entire; transitions between these two shapes not rare. Lobes of smaller pinnules with straight or laterally slightly protracted margin, scarcely erose. Upper pinnae little reduced, the terminal pinna with larger pinnules of the shape described first and then almost conform to the lateral pinnae, or very few pinnae more strongly reduced, with a few transitions from pinnate pinnae to incised pinnules. Upper pinnules of lateral pinnae little reduced, not less than $\frac{2}{3}$ the size of the larger ones, the pinna-apex triangular, acuminate, or rhombic and sometimes subobtuse in paucijugate leaves, narrowly connected with one of the uppermost pinnules, asymmetric, broadly cuneate or subtruncate at the base, there lobed, upward crenate, soriferous, with interrupted sori. Sterile pinnules shallowly crenate (not sharply dentate). Veins immersed or slightly raised, $\pm$ evident, free, 2—4 x forked, $\frac{3}{4}$ —1 mm apart. Sori continuous in entire, interrupted in incised pinnules, on 2—12 vein-ends; indusium pale, 0.3 mm wide, entire, almost or quite reaching the margin, rarely to 0.5 mm wide and not reaching the margin by about half its width, not reflexed and scarcely bulging at maturity. Spores yellowish, verruculose, trilete, ca. 27 μ .

Ecology. Terrestrial in thickets and forests, on sand or clay, 700—1100 m.

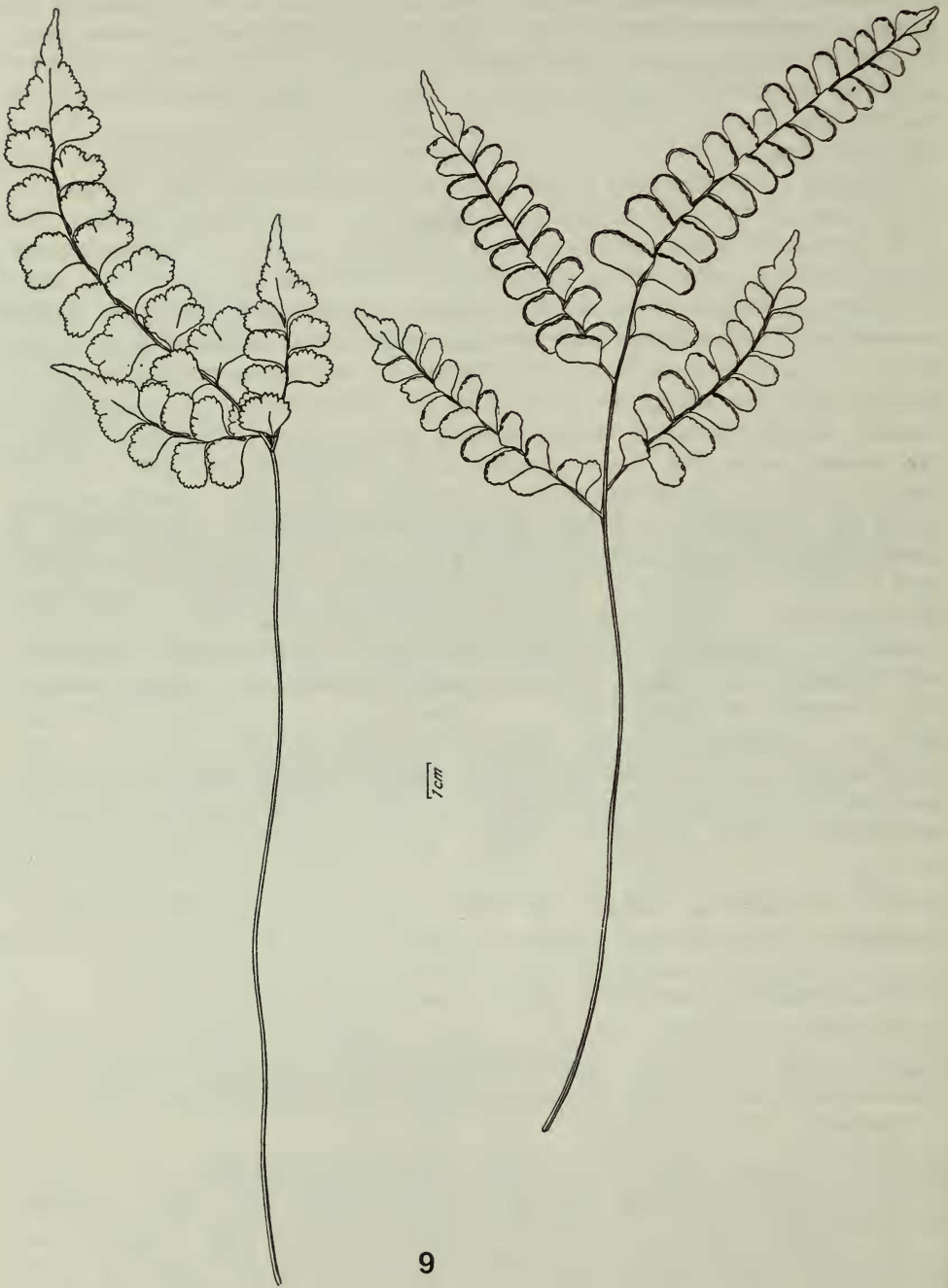
Distribution. Southern China and Indo-China.

CHINA. Kwangsi: *Tsang* 22638 (GH, P, Pic-Ser, isotypes).

INDO-CHINA. Annam: *Vincens* s.n. (BO, K, MICH, P, SING; several coll.); *Cadière* 11 (P); *Poilane* 3378 (BISH, BO, MICH, P), 3412 (HBG, MICH), 4413 (GH, HBG), 4614 (P); *Fleury* (*Chevalier* 38646) (P); *Chevalier* 38819, 38834 (P). — Cambodia: *Bouillod* 69 (P).

Notes. A distinctive species, and in spite of the great variability of the foliage readily recognized by its dark, abaxially quite terete axes. Ching (1959) completely misunderstood its affinity. The type of *L. hainanensis* bears some resemblance to *L. austro-sinica* (see under *L. orbiculata* var. *commixta*); there may be some hybridization, but *L. austro-sinica* does not seem to have been found in Hainan.

8. ***Lindsaea javanensis*** Blume En. Pl. Jav. (1828) 219; Tardieu-Blot & Christensen Fl. Gen. I.-C. 7 (1939) 124. — *Schizoloma javanense* (Blume) Holttum Rev. Fl. Mal. 2 (1954) 349, fig. 202.



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Fig. 9. *L. austro-sinica*. Left: sterile lamina (Vincens s.n., Annam, P). Right: fertile lamina (Bouillod 69, P).

TYPE: Blume s.n., Java (L.) — *L. flabellulata* Dryander var. *gigantea* Hooker Sp. Fil. 1 (1846) 211, pl. 63 c. — *L. orbiculata* (Lam.) Mett. ex Kuhn var. *gigantea* (Hooker) Mett. ex Kuhn Miq. Ann. Mus. Bot. Lugd.-Bat. 4 (1869) 279. — *L. tenera* Dryander var. *gigantea* (Hooker) Holttum Gard. Bull. S.S. 5 (1930) 65. — *L. gigantea* (Hooker) C. Christensen Bot. Jahrb. 66 (1933) 53. TYPE: Griffith s.n., Assam & Khasya Hills (K). — *L. orbiculata* (Lam.) Mett. ex Kuhn var. *deltoidea* Wu Bull. Dep. Coll. Sci. Sun Yatsen Univ. 3 (1932) 134, pl. 52. — *L. chienii* Ching var. *deltoidea* (Wu) Tagawa Acta Phytotax. Geob. 6 (1937) 37; Col. Ill. Jap. Pterid. (1959) 54, 226. Type: Sin 180, Kwangsi, China (not seen), — *L. liangkhwangensis* Ching Fl. Reip. Pop. Sin. 2 (1959) 269, 372, ex char. et synon. Type: Hsu 00813, Kwangtung, China (not seen).

For further synonymy and description see Fl. Mal. (sp. 5).

Distribution. From S. Japan and S.E. China to Assam and W. Malasia; reported by Ching (1959) from the Chinese provinces of Kwangsi and Kwangtung.

Geographically selected citations:

JAPAN. Ryukyu: Yakushima, *Kawabata* 834, 973 (TOFO), 13890 (US). Amami Oshima, *Hutch* 21266, 21606 (TOFO). Okinawa, *Tawada* 34 (TAI); *T. Ito* s.n. (TAI); *Naito* s.n. (KAG).

TAIWAN: *Ream* 478 (MICH); *Nakamura* 527 (TAI); *Simizu* 3801 (TAI).

INDO-CHINA. Tonkin: *Pételot* 3422 (BM, US), 3646 (P). — Annam: *Poilane* 4375 (P); *Cadière* 137 (P).

THAILAND: *Hennipman* 937 (L); *Tagawa, Iwatsuki & Fukuoka* T 1259 (U), 1514 (L,U); *Smitinand* 1262 (K).

BURMA: *Sidney* s.n. (US).

INDIA. Assam: *Griffith* s.n. (K, S-PA, type of *L. flabellulata* var. *gigantea*); *Mann* s.n. (B, BO, HBG, K, L, MICH, P, SING, S-PA); *Jerdon* s.n. (K); *Godwin Austen* s.n. (P).

Notes. As noted in Fl. Mal., the Continental-Asiatic and Japanese specimens of this species are not in all respects like the Malasian ones. They are as a rule more amply bipinnate, the large, asymmetric, terminal segment forming a relatively smaller portion of the pinna; the two forms are sometimes present together on one rhizome, e.g., *Cadière* 137 from Annam (P). The continental form often — but not always — has more strongly intramarginal indusia. There is probably some hybridization with *L. chienii*.

9. ***Lindsaea chingii*** C. Christensen Ind. Fil. Suppl. III (1934) 121, based on: *L. chinensis* Ching Sinensia 1 (1929) 5, non (L.) Mettenius ex Kuhn (1868) (= *Sphenomeris ch.*); Hu & Ching Ic. Fil. Sin. I (1930) pl. 20; Ching Fl. Reip. Pop. Sin. 2 (1959) 263. Type: *Ching* 7968, Tsing Lung Shan, Kwangsi, China (not seen).

Fig. 6

Rhizome short- to very short-creeping, $1\frac{1}{2}$ –2 mm in diam.; scales castaneous, very narrowly triangular, about the apical $\frac{1}{3}$ uniseriate, up to 6-seriate at the base, up to $2\frac{1}{3}$ mm long. Leaves close to clustered; petioles ca. 12–20 cm long, $\frac{1}{2}$ –1 × as long as the lamina, medium to dark brown or paler in the upper part, adaxially broadly sulcate and green-margined above, abaxially in the upper part obtusely bi-angular, ± convex, scarcely marginate. Lamina oblong, ca. 15–22 cm long, bipinnate, with ca. 6–10 well-developed pinnate pinnae to a side, without a

conform terminal one; colour olivaceous when dry, texture herbaceous; primary rachis abaxially bi-angular, reddish brown or mottled, upward stramineous. Pinnæ sessile, laxly ascending, very narrowly lanceolate, acuminate, the larger ones 3–10 cm long, 1–1½ cm wide, with ca. 8–18 well-developed pinnules to a side, the lower ones not, the upper ones $\pm$ contiguous; secondary rachises slender, pale, greenish, abaxially flat, upward gradually narrowly marginate. Pinnules spreading or slightly ascending, dimidiate, sub-quadrangular or $\frac{1}{4}$ -elliptic in outline, the larger ones 4–7 mm long, 4–5 mm wide, as long as wide to almost $1\frac{1}{2} \times$ as long as wide, cuneately subpetiolulate at the base. Larger pinnules with straight or slightly concave lower margin, often little narrowed to the apex, irregularly incised from the upper and outer edge, the incisions oblique, usually one major one halfway the upper margin, reaching down to $\frac{1}{3}$ or $\frac{2}{5}$, in addition 1 or 2 shallower ones on the outer and a few on the upper margin on both sides of the deeper one; lobes subdigitately divergent, $\frac{3}{4}$ –1½ mm wide, $\frac{1}{2}$ –2 mm long, the basal part parallel-sided, at least some subspathulately broadened at the sorus, with convex sides, the outer edge with one or two apiculi to ca. $\frac{1}{3}$ mm long, less often only erose and rounded or subtruncate. Upper pinnæ gradually reduced with transitions to the pinnules of the leaf-apex; upper pinnules gradually and strongly reduced, cuneate and pluri-, then uni-apiculate, some denticuliform ones confluent with the pinnatifid, narrowly lanceolate, acute pinna-apex of ca. 1 cm. Veins immersed, $\pm$ evident, simple or once forked, 1 or 2 running to each lobe. Sori single in the lobes, uni- or binerval; indusium pale, $\frac{1}{4}$ –1 cm long, 0.3–0.4 mm wide, with straight or convex or in binerval sori often somewhat concave base, free at the sides, erose, overtopped by the apiculus, otherwise almost reaching the outer margin of its segment. Spores like those of *L. chienii*, ca. 23–25 μ .

Distribution. Tonkin; described from Kwangsi, China, and not reported from other provinces by Ching (1959).

Ecology. In thickets on dry sand or clay; altitude not noted.

INDO-CHINA. Tonkin: *Tsang* 27183 (E,K), 29330 (A,E,K,P); *Balansa* 121 (BM).

Notes. I have not seen the type of *L. chingii*, but Ching's good description and Hu & Ching's figure are not open to misinterpretation. The description was evidently based on a young specimen. The description given above was newly made from seven presumably full-grown specimens.

L. chingii is a well-marked species and is apparently rather closely related to the following.

10. *Lindsaea bouillodii* Christ Not. Syst. 1 (1909) 59. Type: *Bouillod* 48, Cambodia (P). — *L. tenera* auct. non Dryander; Tardieu-Blot & Christensen Fl. Gén.I.-C. 7 (1939) 126, and of other authors. — *Schizoloma tenerum* auct. non (Dryander) Holttum Rev. Fl. Mal. 2 (1954) 348, fig. 201. — *L. cambodgensis* auct. non Christ; Kramer *Blumea* 15 (1968) 563.

For further synonymy and description see Fl. Mal. (sp. 2).

Distribution. Indo-China to Java and Borneo.

CHINA. Hainan: *Eryl Smith* 1478 (SING).

INDO-CHINA. Tonkin: *Sollet* 3512. — Annam: *Pételot* 3512 (US). — Cambodia: *Pierre* 5767, 5787 (P); *Bouillod* 48 (P, type); *Eryl Smith* 2303 (BM,K,P), 2304 (K); *Kerr* 7582(K), 15485 (BM, K).

THAILAND. v. Beusekom 789, 791 (L, p.p. min.); Smitinand 5469 (K); Eryl Smith 1878 (K).

Notes. A specimen labelled "China, Forbes 506" (p.p.) in BM is perhaps from elsewhere.

See also under *L. tenera* among the insufficiently known species.

11. ***Lindsaea schizophylla*** (Baker) Christ Journal de Bot. 21 (1908) 234.— *Davallia schizophylla* Baker Syn. Fil. 2nd ed. (1874) 468. Type: *Thwaites CP 3903*, Ceylon (BM; specimens with the same number but prob. from several collections in B, BO, P, W). — *Davallia trichomanoides* auct. non (Dryander) Beddome; Beddome Ferns Br. India 2 (1868) pl. 178. — *L. orbiculata* auct. non (Lam.) Mett. ex Kuhn; Beddome Ferns Br. India (1892) 75, in part.

Rhizome rather short-creeping, $1\frac{1}{2}$ — 2 mm in diam.; scales castaneous to fuscous, narrowly triangular, shortly uniseriate at the apex, up to ca. 8-seriate at the base, to 2 mm long. Leaves not clustered, a few mm to 1 cm apart; petioles ca. 12 — 25, often about 20 cm long, brown, dark at the base, reddish or pale brown to stramineous near the apex, adaxially sulcate and sometimes pale-margined upward, abaxially at least in the upper part acutely bi-angular but scarcely sulcate. Lamina oblong or narrowly oblong, sometimes subtriangular, 12 — 20 cm long, half as long as to equaling the petiole, dark or olivaceous green when dry, herbaceous (mostly thinly), bipinnate & bipinnatifid, less often at the base tripinnate & pinnatifid, or in small plants bipinnate & pinnatifid; primary rachis stramineous or pale brown at the base, abaxially bi-angular, adaxially deeply sulcate. Major pinnae 1 — 4 to a side, ascending or arcuately ascending, with a petiolule of a few mm, 5 — 10 cm long, $1\frac{1}{2}$ — 2 cm wide, acuminate, often slightly narrowed at the base; secondary rachises abaxially flattened, greenish, upward gradually marginate. Secondary pinnae (pinnules) slightly ascending, the lower ones not contiguous, shortly petiolulate, up to 8 major ones to a side, pinnate & pinnatifid or only pinnatifid, or the basal ones of basal pinnae & bipinnatifid; segments cuneate, bifid, twice bifid, or simple, those on the anterior side larger and more numerous than on the posterior side, the pinnules strongly anadromous. Ultimate divisions mostly 2 — 5 mm long, at the base 0.3 — 0.5 mm wide, cuneately broadened from the base, 0.5 — 1 mm wide just below the sorus, at the sorus again and usually $\pm$ spatulately broadened, there 1 — $1\frac{1}{3}$ mm wide, outer margin rounded to acute, usually erose, sometimes truncate and then not at right angles to the vein. Upper pinnae rather abruptly reduced, pinnate and twice bifid, those above again simpler and, like the upper pinnules, etc., gradually confluent into the pinnatifid, acute lamina-, pinna-, etc., apices. Sterile leaves sometimes only with short, pinnate & twice bifid pinnae, then linear; sterile lobes subacute or acute, not spatulately broadened. Veins immersed, single or rarely paired in the lobes, evident, especially their clavate ends on the adaxial side. Sori uni-, less often binerval; indusium yellowish, delicate, subentire or lobulate-erose, if short with convex base and adnate at the narrowed sides (not pouch-shaped), if longer often with concave base and free at the rounded sides, $\frac{1}{3}$ — 1 mm long, $\frac{1}{3}$ — $\frac{1}{2}$ mm wide, not reaching the margin by its width or more, scarcely bulging at maturity. Spores pale brown, trilete, smooth, ca. 22μ .

Ecology. Terrestrial in montane forests, ca. 1600 — 2000 m.

Distribution. Endemic in Ceylon; most collections with data on exact provenance from Adam's Peak, only *J. Smith* s.n. marked "Südspitze".

CEYLON. *Ferguson* s.n. (GH, US); *Robinson 113a* (K); *Matthew* s.n. (K); *Alwis* s.n. (Z); *Thwaites CP 3903* (BM, type; dupl.? in B, BO, E, K, P, W); *Wall 1012* (P, S-PA); *J. Smith* s.n. (P, S-PA); *Sledge 608* (K, U); *Skinner* s.n. (K); *Hutchinson* s.n. (E).

Notes. The closest relative of this species is probably *L. orbiculata* var. *commixta*, with which it seems to be interfertile to a certain degree. Putative hybrids are reported under that taxon.

12. ***Lindsaea cambodgensis*** Christ Not. Syst. 1 (1909) 58; not of Kramer Blumea 15 (1968) 563. Type: *Bouillod 61*, Cam-Chay Mts., Cambodia (P). — *L. parvipinnula* K. Iwatsuki Acta Phytotax. Geob. 19 (1961) 6, fig. 13. Type: *Tagawa & Iwatsuki 3204*, Yakushima, Japan (KYO, not seen; photogr. in U).

For a description the reader is referred to the very complete original one of *L. parvipinnula* to which only a few points are added here.

Rhizome scales castaneous, very narrowly lanceolate, rather shortly uniseriate at the apex, up to 5-seriate at the base, to almost 2 mm long. Petioles to 22 cm long. Lamina to 15 x 8 cm, not rarely subtripinnate & pinnatilobate at the base, i.e., the basal pair(s) of pinnae with one or a few pinnate pinnules on both sides. Pinnae subsessile. Pinnules scarcely dimidiate, the basal ones of larger pinnae always with at least one incision going well beyond the receptacle, sometimes with more and deeper incisions, especially if they are transitional between pinnate secondary pinnae and non-pinnate pinnules; upper pinnules entire, flabellate-cuneate, gradually reduced, usually one connected with the very obtuse, cuneate-flabellate, often cleft or lobed terminal segment. Sori on (1 —) 2 — 5 vein-ends, basally convex if very short, often concave if longer, $\frac{3}{4}$ — 3 mm long. Indusium greenish, subentire or slightly erose, 0.3 — 0.4 mm wide, not reaching the erose margin by the same distance or a little less. Spores yellowish, trilete, nearly smooth, ca. 25 μ . Juvenile, sterile plants with unevenly digitate-crenate pinnules.

Ecology. According to Iwatsuki (loc. cit.) terrestrial on the floor of light forest at lower elevation.

Distribution. Yakushima and Okinawa, Japan; Cambodia. Also reported from Amami-Oshima by Iwatsuki (loc. cit.); no material seen by the present author.

JAPAN. Ryukyu: Yakushima, *Saiki* s.n. (KYO, paratype of *L. parvipinnula*); *Iwatsuki 2978* (KYO, id.); *Ohtani E-12* (U); *Furuse* s.n. (TOFO); *Satake* s.n. (TOFO); *Kawabata 988* (TOFO); *Hutch 18970* (TOFO); *Yamaguchi 6* (TOFO); *Kawanabe 5045* (TOFO, isoparatype of *L. parvipinnula*), 4960 (KYO, TOFO, paratypes of *L.p.*); *Ohba 66727* (U). Okinawa, *Tawada 1556* (KYO, TAI, iso-paratypes of *L.p.*), 114 (KYO, paratype of *L.p.*); *Tamaki 723* (KYO, id.); *Ito* s.n. (KYO),

INDO-CHINA. Cambodia: *Eryl Smith 2304* (K); *Bouillod 61* (P, type).

Notes. The disjunct distribution of this species is remarkable. The Cambodian specimens are a little coarser in texture and dissection than the Japanese ones which may be infraspecifically distinct.

The rather long-creeping rhizome, the small, cleft pinnules and the delicate lamina characterize this species rather well.

13. ***Lindsaea heterophylla*** Dryander Trans. Linn. Soc. 3 (1797) 41, pl. 8 fig. 1; Beddome Ferns S. India (1863/64) 70, pl. 206; Dunn & Tutchter Kew Bull. Add. Ser. 10 (1912) 338; Gibbs Common Hongkong Ferns (1927) 14, pl. 7; Tagawa Acta Phytotax. Geob. 7 (1938) 197; Ito Fil. Jap. III. (1944) pl. 22; Iwatsuki Acta Phytotax. Geob. 19 (1961) 3. — *Schizoloma heterophyllum* (Dryander) J. Smith Hook. J. Bot. 3 (1841) 414; Beddome Ferns S. India (1863/64) 9, pl. 26; Blatter & d'Almeida Ferns of Bombay (1922) 55, fig. 18; Merrill Lingn. Sc. J. 5 (1927) 13; Ogata Ic. Fil. Jap. 3 (1930) pl. 148; Ching Fl. Reip. Pop. Sin. 2 (1959) 273, pl. 23 fig. 7 — 11; Chun, Chang & Chen Fl. Hain. 1 (1964) 57. Type: *Robertson* s.n., Malacca (BM). — *Schizoloma intertextum* Ching Fl. Reip. Pop. Sin. 2 (1959) 274, 374. Type: Herb. Biol. Kwangsi Univ., Kwangsi, China (not seen).

For further synonymy and description see Fl. Mal. (sp. 7).

Distribution. Madagascar and Mascarenes, S. India and Ceylon to Ryukyu and Central Malesia.

Geographically selected collections:

JAPAN. Ryukyu: Okinawa, *Conover* 958, 1173 (US); *Sonohara* 65 (US); *Ogata* 195 (BM); *Tawada* 130 (U); *Tagawa & Iwatsuki* 4845 (US). Iriomote, *Nishida* 540 (US); *Walker & Tawada* 6635 (MICH, US). Yonaguni, *Hatusima* 24424 (TOFO).

TAIWAN. *Steere* s.n. (MICH); *A. M. Evans* 089 (TENN).

CHINA. Kwangtung: Canton Chr. Coll. Herb. 1573 (US); *Tsang* 26045 (A); *Gressitt* 1213 (BM, E, GH); *Petersen* s.n. (L). — Kwangsi: *Morse* 6 (US); *Ching* 7758 (US; paratype of *Sch. intertextum*); *Tsang* 22106 (GH, Pic-Ser; id.), 23909 (MICH). — Hainan: *Eryl Smith* 1500 (K, SING, US); *Gressitt* 966 (E, GH); *Hancock* 4 "p. p." (BM). — Hong Kong: *Cadière* 92 (MICH, SING); *Eryl Smith* 1479 (K, SING); *Taam* 2210 (US); *Wright* s.n. (GH, K, US); *Matthew* 311, 312 (E); *Hance & Simson* 667 (W). — Reported from Yunnan by Ching (loc. cit., as *Sch. intertextum*).

INDO-CHINA. Tonkin: *Bourret* 7 (MICH); *Balansa* 125 (K), 1972 (K, MICH); *Tsang* 29370 ((A, p.p.). — Laos: *Poilane* 2117 (GH, MICH, S-PA). — Annam: *Poilane* 5241 (GH, MICH); *Cadière* 49 (GH). — Cambodia: *Eryl Smith* 2306 (K).

THAILAND. *H. M. Smith* 202, 212 (US); *Tagawa, Iwatsuki & Fukuoka* T 592 (U, US), T 1311, 1831 (U); *Tagawa* 3951 (U); *Hennipman* 3588, 3937a (L); *Kerr* 779, 2372, 6841 (K).

INDIA. Bombay: *Meebold* 9613 (S-PA). — Mysore: *Blanford* s.n. (E); *Law* s.n. (GH); *Meebold* 9614 (S-PA). — Madras: *Beddome* s.n. (BM, E, K); *Faucheux* s.n. (BM). — Kerala: *Beddome* s.n. (BM).

CEYLON. *Thwaites* CP 3861 (B, BM, E, K); *J. Smith* s.n. (S-PA); *Wall* s.n. (B, GH).

Note. The Chinese specimens have mostly broader, more rigid and erose indusia, but are connected with the typical form by intermediates.

14. **Lindsaea ensifolia** Swartz Schrader, J. Bot. 1800 (1801) 77; Dunn & Tutcher Kew Bull. Add. Ser. 10 (1912) 338; Gibbs Common Hongkong Ferns (1927) 12, pl. 6; Tagawa Acta Phytotax Geob. 7 (1936) 197, 198; Ito Fil. Jap. III. (1944) pl. 23; Iwatsuki Acta Phytotax. Geob. 19 (1961) 2; Kramer Blumea 15 (1968) 564. — *Schizoloma ensifolium* (Swartz) J. Smith Hook. J. Bot. 3 (1841) 414; Beddome Ferns S. India (1863/64, 1873) 9, pl. 25; Ferns Br. India (1892) 80, pl. 41; Blatter & d'Almeida Ferns of Bombay (1922) 53, fig. 17; Merrill Lingn. Sc. J. 5 (1927) 13; Ogata Ic. Fil. Jap. 6 (1935) pl. 293; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 129, fig. 15 1–2; Ching Fl. Reip. Pop. Sin. 2 (1959) 273, pl. 23 fig. 1–6; Chun, Chang & Chen Fl. Hain. 1 (1964) 56, fig. 24. Type: coll. unknown, Mauritius (S-PA). — *L. griffithiana* Hooker Sp. Fil. 1 (1846) 219, pl. 68 B. — *Schizoloma griffithianum* (Hooker) Fée Gen. Fil. (1852) 108. Type: *Griffith* s.n., Mergui, Burma (K).

For further synonymy and description see Fl. Mal. (sp. 8).

Of the three subspecies recognized by Kramer (loc. cit.) only one occurs in the area of the present paper, viz. ssp. *ensifolia*.

Distribution. Old World tropics to Malesia, western Melanesia, and tropical Australia.

Geographically selected citations:

JAPAN. Ryukyu: Iriomote, *Nishida* 534 (US)*.

TAIWAN. *Henry* 1497 (E), 1502 (B); *Faurie* 130 (S-PA).

CHINA. Kwangsi: *Tsang* 24699 (A, MICH). — Kwangtung: *Lau* 20178 (A); *Merrill* 10899 (GH); *Dalziel* s.n. (E). — Yünnan: *Wang* 81126 (A). — Hainan: *Lau* 6369 (MICH); *Wang* 34040 (E, GH), 34261 (MICH). — Hong Kong: many coll., e.g., *Eryl Smith* 1501 (SING, US); *Taam* 1409 (MICH, US), 2211 (US); *Topping* 605 (GH, US), 608 (US); *Fortune* 3 (BM, E), 27 (E, L); *Matthew* 304 (E).

INDO-CHINA. Tonkin: *Balansa* 107 (K). — Laos: *Colani* 4111 (BM); *Poilane* 2116 (BM, HBG, MICH). — Annam: *Cadière* 50 [67] (K). — Cambodia: *Pierre* 5794 (BM, HBG, K). — Cochin China: *P. Condor*, *Harmand* 875 (MICH, SING); *Pierre* 5743, 5801, 5802 (MICH), 5794 (E, HBG).

THAILAND. *Eryl Smith* 1236, 1879, 1880, 1904 (K, SING); *Molesworth-Allen* 2154 (S-PA); *H. M. Smith* 599 (GH, MICH, US); *Tagawa* 3937 (U); *Tagawa, Iwatsuki & Fukuoka* T 594, 1262, 1309 (L, U); *v. Beusekom* 316 (L); *Larsen, Smitinand & Warneke* 659, 896 (L).

BURMA. *H. M. Smith* 575 (US); *Dickason* 8007, 8020 (A); *Sidney* 33 (BM, US); *Brandis* 274 (K); Mergui, *Griffith* s.n. (K, type of *L. griffithiana*).

SIKKIM. *Gamble* 347 A (E); *Clarke* 36796 B (E).

NEPAL. *Wallich* 93 or s.n. (B, L, US).

BANGLA DESH. *Gamble* 7909 (E, K, US); *Cowan* 924 (E); *Hooker & Thomson* s.n. (B, GH, K, W); *Thomson* s.n. (B, E, S-PA, U).

* A specimen labelled "Yokohama", *Schottmueller* 122 "p.p." (B), is probably mislabelled; the species was not reported from Honshu by Tagawa (1959).

INDIA. Assam: *Mann s.n.* (B. E, HBG, K, L, SING, S-PA, US); *Clarke 42947 B* (K, US); *Meebold 7390* (K); *Hooker s.n.* (B). — Rajasthan: *Gamble 2387 A* (K). — West Bengal: *Gamble 409 A* and *s.n.* (K), *409 B* (E). — Madras: *Gamble 15974* (K, US). — Kerala: *Wight 214* (B).

CEYLON. *Thwaites CP 1382* (B, BM, E, GH, S-PA, U, W); *Hance 32* (W); *Walker s.n.* (B, BM, GH, K, W); *J. Smith s.n.* (S-PA); *Naylor Beckett 61* (E, GH); *Koenig s.n.* (L); *Freeman 51, 52, 89* (BM); *F. Schmid 1090 1125* (BM); *Mucrae s.n.* (E).

PUTATIVE HYBRIDS IN SECTION SCHIZOLOMA

Four specimens in herb. TOFO combine characters of two species each of section Schizoloma and are presumably of hybrid origin. *Yamaguchi 14* from Yakushima has a short rhizome and the leaf pattern of *L. orbiculata* var. *commixta* but pinnules rather like *L. cambodgensis*; its spores are abortive. *Yamaguchi 9* from the same island is somewhat like the preceding but looks more like a hybrid between *L. chienii* and *L. cambodgensis*; it also has abortive spores. *Satake s.n.*, also from Yakushima, is about midway between *L. kawabatae* and *L. chienii*. *Oka 13890* from Iriomote has very irregularly dissected subbipinnate leaves with features of both *L. orbiculata* and *L. heterophylla*. The spores of the two last-named collections are well-developed.

For supposed hybrids between *L. orbiculata* var. *commixta* and *L. schizophylla* see under the former.

SECTION *Synaphlebiium* (J. Smith) Diels

15. ***Lindsaea malayensis*** Holttum Gard. Bull. S. S. 5 (1930) 69, fig. 8; Rev. Fl. Mal. 2 (1954) 335, fig. 194. Type: *Md. Haniff 4032*, G. Kerbau, Perak, Malaya (SING).

For description see Fl. Mal. (sp. 15).

Distribution. Malay Peninsula: Malaya and southern Peninsular Thailand.

THAILAND. *Tagawa, Iwatsuki & Fukuoka T 4781* (U).

16. ***Lindsaea napaea*** v.A.v.R. Bull. Jard. Bot. Btzg. II. 20 (1915) 19, pl. 3; Holttum Gard. Bull. S. S. 5 (1930) 66; Rev. Fl. Mal. 2 (1954) 330, fig. 189. Type: *Teijsmann 16616*, Mt. Dai, Lingga Is. (BO).

For description see Fl. Mal. (sp. 16).

Distribution. Sumatra, Malaya, and adjacent islands; southern Peninsular Thailand.

THAILAND. *Kerr 15227* (K).

17. ***Lindsaea malabarica*** (Beddome) Baker ex Christensen Contr. U. S. Nat. Herb. 26 (1931) 295; Baker Syn. Fil. 2nd ed. (1874) 545 (in indice; invalid combination, species not accepted). — *Schizoloma malabaricum* Beddome Ferns Br. India (1868) pl. 268, with descr. — *Sch. lobatum* (Poiret) Beddome var. *malabaricum* (Beddome) Beddome Ferns Br. India (1883) 79, (1892) 79, pl. 39 (err. '*malabarica*'). Type: Beddome s.n., South Canara, Mysore, India (K).

Rhizome short-creeping or rather so, 1–1½ mm in diam.; scales not seen. Leaves close to almost 1 cm apart; petioles stramineous to pale reddish brown, quadrangular except at the extreme base, scarcely sulcate except adaxially, ca. 10–20 cm long, $\frac{2}{3}$ to about as long as the lamina. Lamina simply pinnate or bipinnate with one or two pairs of lateral pinnae and a conform terminal one, medium green when dry, herbaceous, ca. 15–35 cm long; pinnule-bearing rachises like the upper part of the petiole. Pinnules ca. 20–35 to a side, $\frac{1}{2}$ –1 × their width apart or the upper ones closer, ascending (often strongly) or the lower ones almost

spreading, parallelogrammoid or subtrapezoid, the major ones 10–12 mm long, $3\frac{1}{2}$ –5 mm wide, $2\text{--}3 \times$ as long as wide; margins straight or the upper and/or lower outward somewhat convex, a distinct outer margin developed or not; basal pinnules sometimes a little reduced, upper pinnules gradually and strongly reduced, a few denticuliform ones connected with the almost linear terminal segment. Veins immersed, $\pm$ evident, once or twice forked, rather close, $\frac{1}{2}$ – $\frac{3}{4}$ mm apart, free or usually the inner ones here and there connivent, rarely truly anastomosing but never regularly so. Upper margin with 3 or 4 oblique incisions to $\frac{3}{4}$ mm deep, reaching or slightly surpassing the level of the receptacle, the lobes laterally narrowed, usually with convex outer margin. Sterile lobes subacute. Sori interrupted, on 2–3 (– 5) vein-ends, with straight or laterally slightly convex, or in the outer sori slightly concave receptacle; indusium pale or greenish, rigid, entire or crenulate, 0.3 mm wide, reaching the margin or nearly so, scarcely reflexed at maturity. Spores not seen.

Distribution. Southern India; recorded from Burma by Christensen (1931) and Dickason (1946), probably in error.

INDIA. Madras: *Ghatak 440* (K). — Mysore: *Beddome* s.n. (K, type).

Notes. With the very limited material at hand I feel uncertain about the status of this species. Yet it does not seem to fit any of the others of the present section. It might be taken for a juvenile form of *L. venusta*, but the juvenile specimens of that species I saw which were in size comparable to the material of *L. malabarica* have more regularly crenate pinnules, shorter sori, and much less rarely anastomosing veins. More material is required in order to establish the variability of *L. malabarica*.

A collection that may represent the mature form is *Thomson* s.n., “Mt. Nilghiri & Kurg” (B, E, GH, K, S-PA, U, US, W). It has uni- or bijugate-bipinnate leaves, larger pinnules (up to 16×7 mm), $\pm$ parallel-sided lobes with straight outer margin, incisions to 3 mm deep going to $\frac{1}{3}$ or in the apical half to the middle of the pinnule, and in the basal half of larger pinnules more or less regularly, elsewhere irregularly anastomosing veins. In some characters it is quite divergent from the material on which the above description is based, but part of the material in S-PA is incompletely fertile and much more like it. It bears some resemblance to *L. lobata* var. *epirotas* but has more deeply and irregularly incised, less elongate, more truncate pinnules and much less regularly anastomosing veins that are closer in the pinnule lobes.

18. *Lindsaea obtusa* J. Smith in Hooker Sp. Fil. I (1846) 224, Type: *Cuming 394*, Malacca (K; dupl. in B, GH, W). — *L. davallioides* auct. non Blume; Ito Fil. Jap. Ill. (1944) pl. 21.

For further synonymy and description see Fl. Mal. (sp. 18).

Distribution. Taiwan and Malesia to western Melanesia; to be expected in southern Thailand.

TAIWAN. *Faurie 245* (S-PA); *Suzuki* s.n. (TAI 6179); *Sasaki* s.n. (TAI 6183).

ANDAMAN IS. South Andaman, *Mann* s.n. (P, S-PA); *Kurz* s.n. (K).

Notes. The specimens from South Andaman are not typical, having smaller and more shallowly incised pinnules than usual. They may represent a local form, but *L. obtusa* is as a whole very variable. — See also the note after *L. lobata* var. *epirotas*, p. 36.

19. ***Lindsaea parallelogramma*** v.A.v.R. Bull. Jard. Bot. Btzig III. 5 (1922) 212; Holttum Gard. Bull. S. S. 5 (1930) 70, fig. 9; Rev. Fl. Mal. 2 (1954) 335, fig. 193.

Type: *Bünnemeijer* 7359, P. Singkep, Lingga Is (BO; dupl. in L).

For further synonymy and description see Fl. Mal. (sp. 22).

Distribution. S. Peninsular Thailand and Malesia.

THAILAND. *Kerr* 14497 (K).

20. ***Lindsaea cultrata*** (Willdenow) Swartz Syn. Fil. (1806) 119; Kramer *Blumea* 15 (1968) 565; not of other authors. Type: coll.?, "Malabar" (B, herb. Willdenow). — *L. decomposita* Willdenow Sp. Pl. (1810) 425; Holttum Gard. Bull. S. S. 5 (1930) 66, fig. 5; Rev. Fl. Mal. 2 (1954) 333, fig. 192, and of other authors, at least in part. Type: coll.? "India" (B, herb. Willdenow). — *L. recurvata* Hooker Sp. Fil. 1 (1846) 222, pl. 70 A. — *Synaphlebium recurvatum* (Hooker) J. Smith Hook. J. Bot 3 (1841) 415; Hist. Fil. (1875) 268, pl. 18 c. Type: prob. *Wallich* sin. dat. (K).

For further synonymy and description see Fl. Mal. (sp. 23).

Distribution. Southern India (?), Ceylon; southern Thailand; Malesia; Orchid I. and Botel Tobago; ? Hainan.

TAIWAN. Botel Tobago, *Chuang & Hsu* 2453 (TAI); *C. C. Hsu* s.n. (U). Orchid I., *Huang & Kao* 7532 (TAI, U); *Fukuyama* s.n. (TAI 6178, 6184); *Sasaki* s.n. (TAI 6181).

CHINA. Hainan: *Hancock* (Kew no. 119) (K; mislabelled ?).

THAILAND. *Eryl Smith* 2301 (BM, K), 2301 B (K); *Hennipman* 3937b (L); v. *Beusekom* 791 (L).

INDIA. S. India, without exact loc., *Gough* s.n. (K, poor, uncertain). — The exact provenance of the types of *L. cultrata* and *L. decomposita*, as cited above, is uncertain.

CEYLON. *Thwaites* CP 982 p.p. (with *L. venusta*) (B, BM, E, GH, K, L, P, S-PA, W); *Sledge* 543, 619, 1229 (K); *Holttum* S.F. 39201 (SING); *Henderson* s.n. (K); *Freeman* 47, 49 (BM), 50 (BM, prob.); *Gardner* 1122 (BM, E, K), 1260, 1261 (B, K); *Ballard* 1077 (K); and others.

Notes. Not all Ceylonese specimens agree with the Indo-Malayan ones. Some are quite typical, others have more strongly reduced upper pinnules, and in many the outermost sorus of the upper margin is not or only in some pinnules, continuous with that of the outer, a fairly constant character in Malesia. As some Ceylonese collections are not divergent, it does not seem advisable to treat the local from as infraspecifically distinct. There may be some introgression of *L. venusta*. The specimens from the islets near Taiwan are very similar; they can be told apart from *L. lobata* var. *epirotas* by i.a. less elongate pinnules, from var. *hainaniana* by less deeply incised pinnules and straighter outer edges of pinnule lobes.

21. ***Lindsaea integra*** Holttum Gard. Bull. S. S. 5 (1930) 67, fig. 6. Type: *Holttum* 20934, Pahang, Malaya (SING; dupl. in BM, BO, K, US). — *L. nitida* auct. non Copeland; Holttum Rev. Fl. Mal 2 (1954) 333, fig. 191.

For description see Fl. Mal. (sp. 25).

Distribution. Malay Peninsula, Sumatra, Borneo; southern Peninsular Thailand.

THAILAND. *Eryl Smith* 1877, 1878 (K), 2298, 2299 (BM, K).

22. ***Lindsaea lobata*** Poiret in Lamarck Encyl. Suppl. 3 (1813) 448; Kramer Blumea 15 (1968) 565. Type: Commerson s.n. Java (P.) — *L. davallioides* Blume En. Pl. Jav. (1828) 218; Hooker Sp. Fil. 1 (1846) 224, pl. 68 A; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 127; Ching Fl. Reip. Pop. Sin. 2 (1959) 271; Chun, Chang & Chen Fl. Hain. 1 (1964) 56; not of Ito Fil. Jap. Ill. (1944) pl. 21. Type: *Blume* s.n., Java (L).

For further synonymy and description see Fl. Mal. (sp. 21).

Distribution. Malesia to western Melanesia and Micronesia. Two continental groups of plants seem referable to this species, but they differ decidedly from the Malesian material and are therefore here described as new varieties. They may prove to be distinct species, although they are certainly very close to *L. lobata*.

a. **Var. *epirotas* Kramer var. nov.**

Petiolus brunneus vel raro nigrescens. Lamina unijugo-bipinnata vel unipinnata. Pinnulae herbaceae, pellucidae, parallelogrammoidales vel paulo angustatae et subtrapezoidales, 11–16 mm longae, 3–5 mm latae, margine exteriori saepe distincto. Margo anterior/exterior incisus, incisionibus basalibus minime duplum spatii a receptaculo ad marginem aequantibus, exterioribus plerumque sensim profundioribus. Lobi basales margine exteriori receptaculoque rectis. Indusium $\frac{1}{4}$ mm latum, marginem attingens vel fere.

Type: *Tsang* 29002, Taai Wong Mo Shan, Tonkin (A; dupl. in E, P).

Petiole medium to dark reddish brown, rarely black, occasionally stramineous. Lamina unijugate-bipinnate or unipinnate, drying medium green. Pinnules herbaceous, translucent, parallelogram-shaped or usually somewhat narrowed to the apex and then subtrapezoidal, 11–16 mm long, 3–5 mm wide, $2\frac{1}{2}$ – $3\frac{1}{2}$ (–4) $\times$ as long as wide; a distinct outer margin usually developed. Inner incisions of the pinnules at least twice as deep as the distance from the receptacle to the margin, outer ones as deep or usually progressively deeper; inner lobes hardly, outer ones somewhat or very little divergent. Inner lobes with straight outer margin and straight receptacle, outer ones usually with weakly convex margin and receptacle. Upper pinnules strongly and gradually reduced. Veins mostly regularly anastomosing, occasionally with an incomplete second series of areoles. Indusium $\frac{1}{4}$ mm wide, nearly or quite reaching the margin.

Ecology. Terrestrial in thickets and woods, 700–1500 m.

Distribution. Indo-China; to be expected in S. E. China.

INDO-CHINA. Tonkin: *Tsang* 27107 (A, K), 29002 (A, E, P, type), 27310 ? [sic] (E). — Annam: *Poilane* 1525 (GH, MICH), 3384 (GH, MICH, SING), 7006 (US), 7169 (BO, K, MICH).

Notes. In many respects close to the Malesian form. The most important difference is in the margin of the lobes and the receptacle which are straight at least in the proximal lobes; the petioles are usually darker and there is often a distinct outer margin. Certain forms of *L. obtusa* are also not unlike this variety; they have wider indusia (0.4–0.7 mm) which are more strongly intramarginal, and usually dry blackish.

b. Var. **hainaniana** Kramer var. nov. — **L. decomposita** auct. non Willdenow; Merrill Lingn. Sc. J. 5 (1927) 12. — *L. cultrata* auct. non (Willd.) Swartz; Merrill loc. cit. 13 (prob.). **Fig. 1.**

Petiolus stramineus. Lamina unijugo-bipinnata vel unipinnata. Pinnulae herbaceae, paulo pellucidae, subligulato-parallelogrammoidales, parce vel haud angustatae, margine exteriori saepe distincto, majores 12–15 mm longae, 5–6 mm latae. Margo anterior/exterior incisus, incisionibus minime triplum spatii a receptaculo ad marginem aequantibus, Lobi margine exteriori et receptaculo parce sed distincte convexis, etiam basales divergentes. Indusium $\frac{1}{5}$ – $\frac{1}{4}$ mm latum, marginem attingens vel fere.

Type: *Liang 63789*, Hainan (US; dupl. in K).

Petiole stramineous. Lamina unijugate-bipinnate or unipinnate, drying bright to dark green. Pinnules herbaceous, little translucent, subligulate-parallelogrammoid, little or not narrowed to near the apex, a distinct outer margin usually developed; major pinnules 12–15 mm long, 5–6 mm wide, over 2 to $2\frac{1}{2}$ × as long as wide. Incisions going to $\frac{1}{3}$ of the width, rarely less but at least 3 × the distance from the margin to the receptacle. Lobes somewhat narrowed, even the inner ones distinctly divergent, most or all, including the inner ones, with weakly but distinctly convex outer margin and receptacle. Veins regularly anastomosing, not rarely with an incomplete second series of areoles. Indusium $\frac{1}{5}$ or $\frac{1}{4}$ mm wide, almost or quite reaching the margin.

Ecology. Terrestrial in forests, sometimes on rocks, in moist places, ca. 1000 m.

Distribution: Hainan.

CHINA. Hainan: *Lau 3817* (BISH, GH, S-PA), 5227 (A, MICH); *Eryl Smith 1469* (K, SING); *McClure* Canton Chr. Coll. 9482 (BISH, BM, K); *Wang 35711* (GH); *Liang 63789* (K, US, type).

Notes. In general appearance not unlike *L. cultrata*, especially the Ceylonese form. It differs in the more deeply incised pinnules with convex outer margin and receptacle, all typical features of *L. lobata*. In most specimens the upper pinnules are less gradually and strongly reduced than in var. *lobata* and var. *epirotas*, but more so than in typical *L. cultrata*. — See also the notes after the last-named species.

23. **Lindsaea venusta** Kaulfuss ex Kuhn Linnaea 36 (1869) 79. Type: *Thwaites CP 982*, Ceylon [dupl. (all?) in B, BM, BO, E, GH, K, SING, S-PA, W]. — *Schizoloma recurvatum* auct. non (Wall. ex Hooker) Moore; Beddome Ferns S. India (1863/64; 1873) 9, pl. 27. **Fig. 2.**

Rhizome slender, 1–2 mm in diam., not very short-creeping, soon almost scaleless; scales light brown, lanceolate, relatively shortly uniseriate at the apex, up to ca. 7-seriate at the base, up to $1\frac{1}{3}$ mm long. Leaves not close, up to $2\frac{1}{2}$ cm apart; petiole stramineous to pale or reddish brown, below obtusely, above acutely quadrangular, adaxially upward sulcate, 8–30 cm long, in small, usually simply pinnate leaves $\frac{2}{5}$, in large, bipinnate ones up to almost $1\frac{1}{2}$ × as long as the lamina. Lamina ca. 10–25 cm long, bright medium or dark to olivaceous green when dry, chartaceous, simply pinnate or more often bipinnate, with 1 or 2 pairs of lateral pinnae and a conform terminal one; primary rachis stramineous or pale reddish brown, abaxially bi-angular. Pinnae (if any) or simply pinnate lamina 10–20 cm long, $1\frac{1}{2}$ – $2\frac{1}{2}$ cm wide (the terminal sometimes larger), ascending or

spreading, subsessile, the lateral pairs (if any) several cm apart, not contiguous, acuminate; secondary rachises stramineous, abaxially bi-angular, shallowly sulcate. Pinnules ca. 25–35 to a side, spreading or slightly ascending, almost their width apart to subcontiguous, parallelogrammoid, trapezoid, or less often subligulate, mostly with $\pm$ parallel upper and lower margins, i.e. hardly narrowed to the apex, both margins straight, or the upper slightly convex, the lower slightly concave, the inner straight, the outer distinct, straight or a little convex, meeting the upper at right angles or at a smaller angle; major pinnules 10–15 mm long, 5–6 mm wide, $2-2\frac{1}{2}$ (–3) $\times$ as long as wide. Upper and outer margin very shallowly crenate, regularly so if sterile, less so if fertile, with rounded to subacute, uninerval lobes, the incisions up to 1 mm deep but usually only $\frac{1}{4}$ or $\frac{1}{2}$ mm, reaching or slightly surpassing the level of the receptacle. Lobes with slightly convex or straight outer margin. Upper pinnules gradually and strongly reduced, one or a few $\pm$ denticuliform ones connected with the small, narrowly lanceolate terminal segment. Veins immersed, $\pm$ evident, mostly twice forked, rather regularly anastomosing, forming a series of areoles $\frac{1}{2}$ –1 mm wide. Sori interrupted by the incisions, on (1–) 2–4 (–5) vein-ends; indusium with at least laterally convex base, pale, entire, $\frac{1}{4}$ mm wide, not reaching the margin by a smaller distance to equaling or slightly surpassing it, scarcely reflexed at maturity, the laminal lobe opposite it often pale on the adaxial side, Spores pale brownish, trilete, smooth, ca. 21 μ .

Ecology. Terrestrial in forests, 200 — 700 m (very few data).

Distribution. Ceylon, apparently not rare; southern Peninsular India.

INDIA. Madras: *Beddome* 40 (E, K), s.n. (BM, K). — Kerala: *Beddome* s.n. (K).

CEYLON. *Thwaites* CP 982 p.p. (B, BM, BO, E, GH, K, SING, S-PA, W, some or all isotypes); *Moon* s.n. (BM); *Lenormand* s.n. (B, fragm.); *F. Schmid* 1110, 1116, 1133 (BM); *Wall* s.n. (BO, GH, S-PA); *Rawson* 554a 3320 (BM); *Ferguson* 36 (GH), 44 p.p. (US); v. *Fridau* s.n. (HBG); *Sledge* 997 (K), 1377 (K, U); *Robinson* 116 p.p. (K); *Naylor Beckett* s.n. (K); *Haycock* s.n. (BM); *Randall* s.n. (BM); *Bradford* s.n. (BM); *Emerson* s.n. (E); *Koenig* s.n. (L).

Notes. In spite of the excellent original description, the wide distribution of the type collection, and the distinctness of the species, *L. venusta* almost fell into oblivion, the name appearing on hardly any herbarium label. The short, submarginal sori and regularly crenate sterile margin are unique in the section but are reminiscent of *L. repanda* of the Bonin Islands (sect. *Schizoloma*), and also of *L. kirkii* of the Seychelles, a similarity already noted by Kuhn (loc. cit.). The affinities of *L. venusta* in section *Synaphlebium* are not clear.

SECTION *Lindsaea*

24. *Lindsaea doryphora* Kramer *Blumea* 15 (1968) 566. TYPE: Alston 13358, Permang, Kalimantan, Borneo (U; dupl. in BM). — *L. scandens* Hooker var. *terrestris* Holttum *Rev. Fl. Mal.* 2 (1954) 327, nom. invalid. (not typified). — *L. lancea* auct. non (L.) *Beddome* of various authors, as to Asiatic material, at least in part.

For description see *Fl. Mal.* (sp. 32).

Distribution. Malay Peninsula to Borneo and the Philippines.

THAILAND. *Kerr* 14458 (K); *Eryl Smith* 463 (K, SING), 1874 (K), 1875 (K, SING), 2269, 2295, 2296 (K).

BURMA. Tenasserim: *Wallich* s.n. (K); *Wight* 219 (B).

SECTION *Aulacorrhachis* Kramer, sect. nova.

Squamae rhizomatis nodulis corticis oblongis insidentes; lamina bipinnata, rhachides saltem sulco adaxiali tomentum perbreve sed sine lente manifestum gerentes; pinnulae dimidiatae, haud incisae, venulis liberis, soris continuis. Species typica (adhuc unica): *Lindsaea caudata* Hooker.

25. *Lindsaea caudata* Hooker Sp. Fil. 1 (1846) 215; Beddome Ferns S. India (1863/64) 73, pl. 217. — *L. trapeziformis* Dryander var. *caudata* (Hooker) Cesati Atti Ac. Sc. Fis. Mat. Napoli 7 (1877) 14. — *L. lancea* (L.) Beddome var. *caudata* (Hooker) v.A.v.R. Handb. 1 (1908) 273. Type: Mrs. Walker s.n., Adam's Peak, Ceylon (K). — *L. lancea* auct. non (L.) Beddome; Beddome Ferns Br. India (1892) 75.

Rhizome terrestrial (prob. short-creeping, only small pieces seen), up to 4 mm in diam.; scales medium brown, narrowly triangular, long-acuminate to the rather shortly uni-bi-seriate apex, to 3 mm long, inserted on oblong mounds of cortical tissue from which they are not quite sharply differentiated at the ca. 6-seriate base. Leaves presumably close; petioles dark brown to blackish, $\pm$ lustrous, rather stout, up to 3 mm in diam. at the apex, abaxially terete, adaxially flattened but scarcely sulcate, ca. 25 — over 60 cm long, about as long as to $1\frac{1}{2}$ x as long as the lamina. Lamina usually dark olivaceous to blackish when dry, herbaceous or chartaceous, ca. 25 — 50 cm long, bipinnate, with 3 — 9 pinnae to a side and a conform terminal one; primary rachis like the petiole, occasionally laterally $\pm$ puberulent just below the pinna bases or rarely throughout, adaxially sulcate, in the groove persistently or fugaciously puberulent. Pinnae laxly ascending, often alternate throughout, with a petiolule of a few mm to 2 cm, ca. 10 — 25 cm long, $2\frac{1}{2}$ — $4\frac{1}{2}$ cm wide, basally not or only anteriorly slightly narrowed, rather abruptly and strongly narrowed near the apex, with ca. 15 — 25 well-developed pinnules to a side; upper pinnae little or not reduced; secondary rachises dark reddish brown or occasionally darker or pale, mostly abruptly discolorous at their insertion, abaxially terete, adaxially sulcate, permanently puberulent in the groove, in the basal part often also laterally, sometimes the posterior pinnule-bases also slightly puberulent; hairs 0.2 — 0.4 mm long, with up to 5 cells, the terminal cell rounded; rachis of the terminal pinna not or not abruptly discolorous. Pinnules spreading or slightly ascending, close to contiguous or slightly overlapping, not rarely touching or overlying the rachis with their inner margin, $\frac{1}{4}$ -elliptic to subligulate, in shape very much like those of *L. parasitica*, *L. doryphora*, and *L. lancea*, cuneate-subpetiolulate at the base, the inner margin straight, the lower straight or basally concave or apically convex, the upper margin outward increasingly convex, broadly rounded into the outer which is not truly distinct, transition between outer and lower margin shortly rounded to subacute; larger pinnules 13 — 22 mm long, 7 — 10 mm wide, 2 ($-2\frac{1}{2}$) x as long as wide. Upper pinnules rather abruptly reduced, a few denticuliform, one or a few connected with the small, narrowly lanceolate, in herbarium specimens often lost pinna-apex (but one specimen, Fendler s.n., GH, with scarcely reduced upper pinnules and a large, flabellate, free terminal pinnule, the terminal pinna with a normal apex). Upper/outer edge of pinnules shallowly and regularly crenate in sterile, quite entire in fertile pinnules; lower base usually pale and distinctly sclerotic. Veins evident, abaxially elevated at the base or throughout, free, 1 — 3 x forked, rather close, ca. $\frac{3}{4}$ mm apart. Sori continuous around the upper and outer margin (except in incompletely fertile

pinnules), with abundant filiform pluricellular paraphyses; indusium brownish, rigid, entire, narrow, 0.2—0.3 mm wide, almost or quite equaling the margin, strongly reflexed and quite concealed at maturity. Spores medium brown, trilete, minutely granulate, ca. 35 — 40 μ .

Ecology and distribution. Confined to Ceylon; hardly any data on habitat and distribution on the island. Probably only in the mountains of the central massif; very few recent collections, perhaps now very rare through destruction of forests.

CEYLON. *Thwaites CP 1380* (B, BM, BO, E, GH, L, P, SING, W), s.n. (K, W); *Ferguson 37* (GH); *Beddome* s.n. (K); *Thomson* s.n. (B, GH, P); *Hooker & Thomson 302* (BM); *Gardner 22* (P.W.), s.n. (BM, K); *Wall* s.n. (B, BO, K, S-PA); *Finlayson* s.n. (BM); *Nietner* s.n. (HBG); *Mrs. Walker* s.n. (K, type); *J. Smith* s.n. (S-PA); *Robinson* s.n. (K); *v. Fridau* s.n. (HBG); *Sledge 821* (U); *Emerson* s.n. (E); *Gower* s.n. (E); *Wight 1916* (E).

Notes. In spite of its similarity to *L. parasitica*, *L. doryphora*, and *L. lancea*, *L. caudata* is readily distinguishable by the pubescence in the adaxial grooves of the leaf axes. It is surprising that this character has not been described before. It is almost unique in the Lindsaeoid ferns, being otherwise only found in the Antillean *Odontosoria uncinella*.

SECTION *Osmolindsaea* Kramer

26. *Lindsaea odorata* Roxburgh Calc. J. Nat. Hist. 4 (1846) 511; Kramer Blumea 15 (1968) 567. Type: a plant from the Garrow Hills, India; no specimen extant, Plate 2578 of Icones Roxburghianae (K) to be regarded as type. — *L. cultrata* (Willd.) Swartz var. *minor* Hooker Sp. Fil. 1 (1846) 204 in part, excl. lectotype. — *L. cultrata* (Willd.) Swartz var. *pallens* Hooker Sp. Fil. 1 (1846) 204; Kunze Linnaea 24 (1851) 276. Lectotype: *de Silva 151* or s.n., Silhet, Assam (K). — *L. cultrata* (Willd.) Swartz var. *attenuata* Hooker Sp. Fil. 1 (1846) 204. Lectotype: *Griffith 862*, Assam (K). — *L. neocultrata* Ching & Wang Acta Phytotax. Sin. 8 (1959) 165, pl. 19 fig. 15; Ching Fl. Reip. Pop. Sin. 2 (1959) 260, pl. 22 fig. 8–9; Chun, Chang & Chen Fl. Hain. 1 (1964) 54, fig. 23. Type: E. Hainan Exped. 893, Tia-lo Shan, Hainan (not seen). — *L. cultrata* auct. non (Willd.) Swartz of nearly all authors, e.g., *Beddome Ferns S. India* (1863/64, 1873) 7, pl. 23; *Nakai J. Coll. Sc. Imp. Un. Tokyo* 31 (1911) 403; *Ogata Ic. Fil. Jap.* 2 (1929) pl. 79; *Tagawa Acta Phytotax. Geob.* 6 (1937) 26, fig. 1 A-C; *Tardieu-Blot & Christensen Fl. Gén. I.-C.* 7 (1939) 120; *Ito Fil. Jap. Ill.* (1944) pl. 16; *Holtum Rev. Fl. Mal.* 2 (1954) 328, fig. 188; *Ching Fl. Reip. Pop. Sin.* 2 (1959) 260, pl. 22 fig. 1–7; *Tagawa Col. Ill. Jap. Pterid.* (1959) 53, 226, fig. 84; *Chun, Chang & Chen Fl. Hain.* 1 (1964) 55.

For further synonymy and description see *Fl. Mal.* (sp. 33). Two varieties in the present area:*

a. Var. *odorata*.

Pinnules incised, sori interrupted; upper pinnules gradually and strongly reduced.

Distribution. Tropical and subtropical Asia from Ceylon, Tibet, and Japan to western Melanesia, Rhodesia and Madagascar. Very common in many parts of Asia.

* A third variety, var. *darjeelingensis* Sen & Sen, was recently described from West Bengal [*Am. Fern J.* 61 (1971) 14].

Geographically selected citations:

JAPAN. Honshu: *Tagawa* 7385 (E, GH, K, L, U); *Tagawa & Iwatsuki* 718 (E, GH, K, L, Pic-Ser, U, US); *Ito* 82 (SING). — Kyushu: *Sugimoto* s.n. (A). — Hachijo Jima: *Ohba* s.n. (TOFO). — Ryukyu: Yakushima, *Tagawa* 789 (K, SING); *Faurie* 4596, 4597 (B, BM, W); *Togasi TNS* 1479 (E, K, S-PA, US).

TAIWAN, *Ream* 461 (MICH); *Hancock* 6 (B, BM, K, US); *Oldham* s.n. (GH, K, W); *Faurie* 618, 619 (S-PA); *Kao* 4116 (TAI).

CHINA. Szechuan: *Wilson* 2671 (BM, E, HBG, K, US, W); *Fang* 3233 (E, GH, US), 3918, 7998 (E, K); *H. Smith* 2065 (S-PA). — Yünnan: *Delavay* 21 (K); *Handel-Mazzetti* s.n. (K); *Cavalerie* 1769, 7060 (E, K); *Forrest* 9358 (E, K), 11756 (BM, E, K, W); *Rock* 7189, 7359 (US); *Tsai* 52429 (US), 55242 (GH, US), 58989 (GH), 60747 (GH, S-PA); *Maire* 66 (S-PA), s.n. (SING, US, W, Z). — Kweichow: *Tsiang* 4584 (E, GH, SING, S-PA, US), 4726 (GH, SING). — Kwangsi: *Ching* 5787 (US); *Tsang* 22715 (A, W). — Kwangtung: *Tsang* 20226 (A, K, US, W), 25219, 25385 25475 (A); *Metcalf* 17512, 17738 (MICH); *Merrill* 1607 (GH).

TIBET. *Forrest* 19953 (E); *Ludlow, Sheriff & Taylor* 7032 (BM).

INDO-CHINA. Tonkin: *Pételot* 581 (US), 5401 (GH). — Annam: *Chevalier* 30690 (K), 30776 (SING).

THAILAND. *Sörensen, Larsen & Hansen* 2335 (E, K); *Smitinand* 395 (K); *Floto* 7405 (K); *Tagawa, Iwatsuki & Fukuoka T* 595 (L, U).

BURMA. *Kingdon Ward* 21160 (BM, GH); *Parish* s.n. (E); *Buchanan* s.n. (E); *Toppin* 4294 (E).

BHUTAN. *Ludlow & Sheriff* 997 (BM, E); *Griffith* s.n. (B, K, W); *Cooper* 2828 (BM).

SIKKIM. *Bor & Ram* 19730 (BM, SING); *Meebold* 2117 (B); *Gamble* 6998 (E), 9961 (K); *Engler* 5483 (B).

NEPAL. *Wallich* 148 or s.n. (B, BM, E, GH, K, US); *Bonner* 134 (BM); *Stainton, Sykes & Williams* 6941 (BM, E, Pic-Ser).

BANGLA DESH. *Clarke* 19626 (BM).

INDIA. Assam: many coll., e.g., *Sinclair* 2950 (E); *Kingdon Ward* 18663 (BM), 18794 (A, BM); *Hooker & Thomson* s.n. (B, BM, E, GH, K, S-PA, U, US, W); *Mann* s.n. (BO, SING, S-PA); *Biswas* 4101 (GH). — West Bengal: *Gupta* 17 (SING); *Bir* s.n. (U, US); *Pichi-Sermolli* 4604, 4635 (Pic-Ser). — Mysore: *Thomson* s.n. (B, BM, E, S-PA, U, W). — Madras: *Ysander* s.n. (S-PA); *Wight* 220 (E); *Bembower* 3 (MICH); *Gamble* 17365 (E); *Noyes* s.n. (GH); *Faucheux* s.n. (BM). — Kerala: *Meebold* 13334 (B, S-PA).

CEYLON. *Holttum SFN* 39212 (SING); *Wall* s.n. (BO, E, GH); *Freeman* 43, 44, 45 (BM); *Thwaites CP* 3070 (B, BM, BO, E, GH, L, W); *Hance* 47 (W); *Nietner* s.n. (B, HBG); *Parish* s.n. (E); *Gardner* 1121 (E).

Notes. Some of the Chinese and Japanese specimens have more widely creeping rhizomes than usual but are not otherwise divergent.

As noted in Fl. Mal., freshly dried leaves of *L. odorata* have a distinct coumarin-like odour. I am much indebted to Dr. K. Iwatsuki, Kyoto, for the following information otherwise not accessible to me. According to Shimada, Sawada, Kozuka, and Kojima (Jap. J. Pharmac. 22, 1968, 37–38; Japanese) coumarin (I) was found in the methanol extract of *L. odorata* ("cultrata") from the Kii Peninsula, Honshu. It is supposed to be present in the living plant [which lacks the odour] as a glycoside of coumaric acid.

b. Var. **japonica** (Baker) Kramer **comb. nov.** Basionym: *L. cultrata* (Willd.) Swartz var. *japonica* Baker Syn. Fil. 1st ed. (1867) 105. — *L. japonica* (Baker) Diels in E. P. Pfl. Fam. I⁴ (1899) 221; Tagawa Acta Phytotax. Geob. 6 (1937) 27, fig. 1 d–e; Ito Fil. Jap. Ill. (1944) pl. 17; Tagawa Col. Ill. Jap. Pterid. (1959) 53, 226, fig. 85; Ching Fl. Reip. Pop. Sin. 2 (1959) 259. Type: *Oldham* s.n., Nagasaki, Japan (K; dupl. in GH).

Rhizome not very short-creeping, $\frac{2}{3}$ –1 mm in diam.; scales not seen. Petioles at least in the basal half, often throughout, castaneous, abaxially terete, 2–7 cm long, mostly shorter than the lamina. Lamina 2–9 cm long, 1–2½ cm wide, with 3–15 pinnules to a side, these their width apart to subcontiguous, spreading, herbaceous, mostly olivaceous when dry, asymmetrically triangular to dimidiate-ovate, obtuse or less often subacute, 4 × 3 to 11 × 5 mm, the basal ones slightly or not reduced, sterile and crenate or with a short sorus near the apex, the middle ones entire, with an unbroken sorus, or rarely with one shallow incision interrupting the sorus. Upper pinnules little reduced, about half as long as the lower ones, the leaf-apex consisting of a cuneate-flabellate, distally always truncate, free or almost free pinnule; or in larger specimens more strongly reduced, some denticuliform ones confluent with the narrow, lobed leaf-apex. Indusium as in var. *odorata*, or in small specimens a little narrower; spores as in var. *odorata*.

Distribution. See below.

KOREA, Cheju Dô (Quelpaert I): *Faurie* 90 (B, BM, E, MICH); *Taquet* 51 (E, W), 2339 4754 (E, K), 3542 (E, S-PA), s.n. (GH, MICH, W).

JAPAN. Honshu: *Ito* 82 (SING). — Hachijo Jima: *Ohsuga* s.n. (TOFO). — Kyushu: *Maximowicz* 120 (B, BM, GH, K, L, S-PA, W); *Oldham* s.n. (GH, K, type), 477 (B); *Kido* 2663 (TOFO); *Tagawa & Iwatsuki* 1077 (E, GH, K, L, U); *Namekata* 11560 (TENN), 11796 (US). — Ryukyu: *Yakushima, Ohba* 66182 (U); *Ito* 83 (SING). Amami Oshima, *Hosoyamada* s.n. (US). Okinawa, *Sonohara, Tawada & Amano* 7096 (BISH, MICH, US); *Conover* 931 (US), 1798 (BISH, US); *Ito* s.n. (US); *Tashiro* s.n. (US); *Ogata* 194 (BM). Ishigaki, *Walker & Tawada* 7283 (US). — Iriomote, *Nishida* s.n. (US); *Walker & Tawada* 6757 (US); *Ito* s.n. (US); *Hatusima* 23046 (TAI).

TAIWAN. *Ito* s.n. (BM, GH); *Swinhoe* s.n. (B); *Oldham* s.n. (BM, W, p.p.); *Wilford* 466 (K); *Faurie* 254 (S-PA); *Ford* s.n. (K).

CHINA. Szechuan: *H. Smith* 13614 (BM, E, S-PA).

Notes. At first sight this might be taken for a small phenotypic form of *L. odorata*, and I am not quite sure that this is not the case, i.e. in view of the disjunct occurrence in western China. After comparison with a large series of typical *L. odorata* it seemed that the combination of small size, dark petiole, unbroken sori, reduced and quite or almost sterile basal pinnules could serve for distinguishing a taxon, but, especially in view of the great variability of *L. odorata* proper, at the varietal level. Small specimens of *L. odorata* from the Philippines look very much like var. *japonica* but have paler axes, broken sori, or both.

27. **Lindsaea himalaica** Kramer spec. nov. — *L. cultrata* (Willd.) Swartz var. *minor* Hooker Sp. Fil. 1 (1846) 204, p.p., excl. lectot. — *L. cultrata* (Willd.) Swartz var. *assamica* Hooker loc. cit., ex char. (no material cited). **Fig. 3**

L. odoratae valde affinis, differt petiolo et saltem dimidio basali rhachidis obscuris, pinnulis margine exteriore distincto, incisionibus tantum singulis vel binis. Type: *Simons* s.n., Bhutan (BM).

Rhizome short-creeping, $1\frac{1}{2}$ mm in diam.; scales reddish brown, very narrowly triangular, the basal half or less biseriate, the apical half uniseriate, up to 4-seriate at the extreme base, up to $1\frac{1}{2}$ mm long. Leaves close to clustered; petiole atropurpureous to blackish, $\pm$ lustrous, abaxially rounded, shorter than the lamina. Lamina linear, simply pinnate, ca. 15–35 cm long, slightly longer than to ca. $3 \times$ as long as the petiole, 2– $3\frac{1}{2}$ cm wide, with (10–) 20–40 pinnules to a side; rachis abaxially rounded or narrowed-rounded, at least in the basal half dark reddish brown to blackish. Pinnules spreading or little ascending, half their width apart to contiguous, subcoriaceous to coriaceous and olivaceous when dry, subtrapezoidal or subparallelogrammoid, little or not narrowed to the truncate or very shortly rounded apex, the base cuneiform-subpetioluliform, abruptly pale-offset from the rachis; larger pinnules 10–18 mm long, $4\frac{1}{2}$ –9 mm wide, 2 – $2\frac{1}{2} \times$ as long as wide. Lower margin straight, upper margin straight or slightly convex towards the apex, meeting the outer margin at right angles or very shortly rounded into it. Upper margin with 1 or 2 very shallow incisions to $\frac{1}{2}$ mm deep; outer margin entire, its sorus continuous with the outermost of the upper margin. Veins immersed, scarcely visible even in transmittent light, free, close, $\frac{1}{2}$ – $\frac{3}{4}$ mm apart, 1 – $3 \times$ forked. Upper pinnules gradually and $\pm$ strongly reduced, one or a few denticuliform ones connected with the small, narrow, lobed, lanceolate-linear leaf-apex; sometimes a few basal pinnules $\pm$ remote and reduced. Sori 2 or 3 per pinnule, usually somewhat convex on the inner margin near the incision(s) of the pinnule; indusium brownish, rigid, entire or nearly so, scarcely narrowed at the ends, 0.4–0.5 mm wide, almost or quite reaching the margin. Spores medium brown, monolete, bean-shaped, smooth, ca. $40 \times 25 \mu$.

Ecology. No data.

Distribution. See below.

BHUTAN. *Griffith* 135 or s.n. (B, GH, K, MICH, syntype of *L. cultrata* var. *minor*); *Simons* s.n. (BM, type).

INDIA. Assam: *Simons* s.n. (BM); *Griffith* s.n. (K, type of *L. cultrata* var. *assamica* ?); *March* s.n. (K). N.E.F.A., *R. S. Rao* 17471 (K).

Notes. Two specimens from N.E. India, *Meebold* 4787 from Manipur (B) and *Watt* 11039 from Assam (GH), approach *L. himalaica* in texture and in outline of pinnules, but have only basally dark rachises and more interrupted sori. They are better regarded as an extreme form of *L. odorata*. With the material at hand *L. himalaica* seems sufficiently distinct to merit specific rank.

SECTION **Psammolindsaea** Kramer

28. **Lindsaea walkerae** Hooker Sp. Fil. 1 (1846) 209, pl. 69A; Beddome Ferns S. India (1863/64) 72, pl. 215; Ferns Br. India (1892) 76; Kramer *Blumea* 15 (1968) 560, 17 (1970) 177. — *Schizoloma walkerae* (Hooker) Kuhn *Chaetopt.* (1882) 346; Tardieu-Blot & Christensen *Fl. Gén. I.-C.* 7 (1939) 128; *Holtum Rev. Fl. Mal.* 2 (1954) 344. Type: *Mrs. Walker* s.n., Ceylon (K; dupl. in B).

For further synonymy and description see *Fl. Mal.* (sp. 35).

Distribution. Ceylon and Indo-China to Malesia, Queensland, and Micronesia. INDO-CHINA. Tonkin: *Balansa* s.n. (P). — Cochin China: *Talmy* s.n. (P); *Bois* 2226 (BM, P).

CEYLON. *Thwaites CP 1379* (B, BM, BO, E, GH, K, S-PA, U, W); Mrs. *Walker* s.n. (B, K, type); *McKenzie* s.n. (K); *Ferguson 43* (US); *Walker* s.n. (GH); *Fendler 2028* (GH); Mrs. *McDonnell* s.n. (K); *Wall* s.n. (BO, GH); *Gardner 1379* (K); *Sledge 1376* (K); *Wight 105 bis* (E); *Emerson* s.n. (E).

SECTION *Isoloma* (J. Smith) Kramer

29. ***Lindsaea divergens*** Hooker & Greville Ic. Fil. (1831) pl. 226; Beddome Ferns Br. India (1892) 76, fig. 38. — *Isoloma divergens* (Hooker & Greville) J. Smith Hook. J. Bot. 3 (1841) 414; Holttum Rev. Fl. Mal. 2 (1954) 337, fig. 195. Type: a *Wallich* collection from herb. Roxburgh (K, herb. Hooker, ?).

For further synonymy and description see Fl. Mal. (sp. 41).

Distribution. Malay Peninsula, Malesia to Borneo and Palawan.

THAILAND. *Kerr 15935* (K).

SECTION *Stenolindsaea* Kramer

30. ***Lindsaea lucida*** Blume En. Pl. Jav. (1828) 216; Tardieu-Blot & Christensen Fl. Gén. I-C.7 (1939) 122; Holttum Rev. Fl. Mal. 2 (1954) 328, fig. 187; Ching Fl. Reip. Pop. Sin. 2 (1959) 263; Chun, Chang & Chen Fl. Hain. 1 (1964) 55; Kramer Blumea 15 (1968) 567. Type: *Blume* s.n., Java (L). — *L. gracilis* Blume En. Pl. Jav. (1828) 217. Type: *Blume* s.n., Java (L). — *L. concinna* J. Smith Hook. J. Bot. 3 (1841) 415, nom subnud.; Hooker Sp. Fil. 1 (1846) 205, pl. 61 B; Tagawa Acta Phytotax. Geob. 6 (1937) 29, fig. G-I; Ito Fil. Jap. Ill. (1944) pl. 19; Ching Fl. Reip. Pop. Sin. 2 (1959) 262. Type: *Cuming 198*, Luzon (K; dupl. in B, E, GH, HBG, L, SING, W). — *L. lobbiana* Hooker Sp. Fil. 1 (1846) 205, pl. 62 C. Type: *Lobb* s.n., Java (K). — *L. kusukusensis* Hayata Ic. Pl. Form. 4 (1914) 211, fig. 143; Ching Fl. Reip. Pop. Sin. 2 (1959) 262. — *L. concinna* J. Smith var. *kusukusensis* (Hayata) Tagawa Acta Phytotax. Geob. 6 (1937) 30. Type: *Hayata & Sasaki* s.n., Kusukusu, Taiwan (not seen), — *L. minima* Ching Sinensia 1 (1930) 52, non Copeland (1929). — *L. changii* C. Christensen Ind. Fil. Suppl. 3 (1934) 121; Ching Fl. Reip. Pop. Sin. 2 (1959) 261. Type: *Chang* s.n., Kuling, Kiangsi, China (dupl. in K). — *L. cultrata* (Willd.) Swartz var. *attenuata* Hooker Sp. Fil. 1 (1846) 204, p.p., excl. lectot.

For further synonymy and description see Fl. Mal. (sp. 42).

Distribution. In continental Asia etc. only ssp. *lucida*, which occurs East to Malesia and the Palau Is.

JAPAN. Ryukyu: *Ishigaki, Walker & Tawada 7182* (MICH, US); *Nishida 312* (US); *Tagawa & Iwatsuki 4486* (US), 4761 (E, K, L, U). Iriomote, *Hatusima 18532* (US); *Bandai* s.n. (TOFO); *Koidzumi* s.n. (US).

CHINA. Kiangsi: *Chang* s.n. (K, isotype of *L. minima* = *L. changii*). — Kwangtung: *Tsang 26755* (A, K). — Hainan: *Eryl Smith 1466* (K, SING, US); *Lau 3596* (BISH, GH, MICH, S-PA), 5107 (MICH); *How 72036, 72725* (GH); *Wang 34571* (E, GH, MICH).

INDO-CHINA. Tonkin: *Pételot* s.n. (BM); *Tsang 29900* (A, E, K, TAI), 30036, 30236 (A, E, K). — Annam: *Sallet 5* (BO); *Cadière 51* (MICH); *Matthew 25* (K), s.n. (BM). — Cochin China: *Gaudichaud* s.n. (B).

THAILAND. *H. M. Smith* 602 (GH, MICH, US); *Hansen & Smitinand* 12264 (L); *Eryl Smith* 922 (K), 1701 (SING), 1559, 1876 (K), 2279 (BM, K); *Kiah* 24297 (K. SING); *Marcan* 1260, 1264 (BM); *Kerr* 9235, 17029 (K); *Sörensen, Larsen & Hansen* 182 (E, K); *Murton* 7 (K); *Iwatsuki & Fukuoka* T 7389 (U).

BURMA. *Rock* 750 (BM, US); *Sidney* 32 (U, US). Tenasserim, *Falconer* s.n. (BO, L); *Wight* 220 (US); *Parish* s.n. (BM).

BHUTAN. *Griffith* 1670 (E).

BANGLA DESH. *King* 61 (US).

INDIA. Assam: *Mann* s.n. (E, HBG, L, S-PA, US); *Griffith* s.n. (B, K); *Day* s.n. (GH); *Barnard* 41 A (BM); *Wenger* 167 (K). — Manipur: *Watt* 6925 (E). — West Bengal: *Thomson* s.n. (B). — Madras: *Gamble* 17365 p.p. (US). — Andaman Is: *Kunstler* s.n. (B). — Not seen from Taiwan. To be looked for in Ceylon.

SUBGENUS *Odontoloma* (Hooker) Kramer

SECTION *Odontoloma*

31. *Lindsaea glandulifera* v.A.v.R. Bull. Jard. Bot. Btzig II. 1 (1911) 9. Type: *Koorders* 15415 B, Besuki, Java (BO; dupl. in K, L). — *L. repens* (Bory) Thwaites f. *minor* Thwaites En. Pl. Zeyl. (1864) 388. — *L. repens* (Bory) Thwaites var. *minor* (Thwaites) Beddome Ferns S. India (1863/64) 72, pl. 214. Type: *Thwaites* CP 1389 p.p. mai., Ceylon [K; dupl. (all?) in B, BM, BO, E, GH, W].

For further synonymy and description see Fl. Mal. (sp. 44).

Distribution. East Java and Lesser Sunda Is.

CEYLON. *Thwaites* CP 1389 p.p. mai. (B, BM, BO, E, GH, K, W, type coll. of *L. repens* f. or var. *minor*); *Hooker & Thomson* s.n. (BM); *Robinson* 110a (K); *Skinner* s.n. (K); *J. Smith* s.n. (S-PA).

Note. The strongly disjunct distribution is of an unusual pattern. The two populations do not seem to be even infraspecifically distinct.

32. *Lindsaea repens* (Bory) Thwaites En. Pl. Zeyl. (1864) 388; Beddome Ferns S. India (1863/64) 72, pl. 209; Ogata Ic. Fil. Jap. 5 (1933) pl. 232, as to plant depicted; Tardieu-Blot & Christensen Fl. Gén. I.-C. 7 (1939) 120; Kramer Blumea 15 (1968) 568, 17 (1970) 180. — *Dicksonia repens* Bory Voy. 2 (1804) 323. Type: *Bory* s.n., Réunion (P). — *L. macraeana* auct. non (Hooker & Arnott) Copeland of later authors, e.g., Holttum Rev. Fl. Mal. 2 (1954) 324, fig. 185; not of Ching Fl. Reip. Pop. Sin. 2 (1959) 266.

For further synonymy and description see Fl. Mal. (sp. 46). In our area this species is only represented by var. *pectinata* (Blume) Mettenius ex Kuhn Miq. Ann. Mus. Lugd. -Bat. 4 (1868) 277; Kramer Blumea 15 (1968) 568. — *L. pectinata* Blume En. Pl. Jav. (1828) 217; not of Holttum Rev. Fl. Mal. 2 (1954) 324. Type: *Blume* s.n., Java (L).

For further synonymy and description see Fl. Mal. (sp. 46, 3).

Distribution. Assam and Indo-China to the Greater Sunda Is. and the Philippines.

INDO-CHINA, Annam: *Evrard* 1872 (BO, GH, K), *Poilane* 3513 (MICH), 3533 (SING), 21852 (BO, GH, K, MICH, SING), 22343 (MICH); *Fleury* (*Chevalier* 38797) (K); *Vincens* s.n. (GH, K, MICH, SING); *Anet* 1919 (BO) — Cochinchina: *Pierre* 5707 (BO, E, GH, HBG, K, MICH, SING), 5707 A (E, K, MICH). — Cambodia: *Poilane* 15175 (K, MICH, SING).

THAILAND. *Smitinand* 860 (K); *Eryl Smith* 634 (BM, K, SING), 2305 (K).

SIKKIM. *Clarke* 36800 C, E, F, 37002 G, M (E).

INDIA. Assam: *Mann* s.n. (B, BO, BRI, E, HBG, L, SING, S-PA, US); *Gammie* 68 (B, W).

CEYLON. *Wall* 1012 (S-PA); *Thwaites* CP 1389 p.p. min. (E), 3389 (B, BM, BO, E, GH, K, S-PA, W); *Ferguson* 29 (GH, US).

Not seen from Burma. A specimen marked "Hongkong in locis umbrosis silvaticis Dec. 67 Dr. M. . . [?]" in herb. P probably mislabelled.

33. ***Lindsaea merrillii*** Copeland Perkins Fragm. (1905) 181; Tagawa Acta Phytotax. Geob. 6 (1937) 33, fig. 2 E, F. Type: *Merrill* 1774, Mindoro, Philippines (MICH; dupl. in B, GH, K, US).

The typical subspecies is confined to the Philippines. In the present area only ssp. *yaeyamensis* is found.

Ssp. ***yaeyamensis*** (Tagawa) Kramer stat. nov. Basionym: *Lindsaea yaeyamensis* Tagawa Acta Phytotax. Geob. 6 (1937) 31, fig. 2 C, D; Ito Fil. Jap. I11. (1944) pl. 18. Type: *Koidzumi* s.n., Iriomote, Ryukyu (KYO, not seen; dupl. in US). — *L. macraeana* auct. non (Hooker & Arnott) Copeland; Ching Fl. Reip. Pop. Sin. 2 (1959) 266.

In most respects similar to ssp. *merrillii* (see Fl. Mal. sp. 48). The petioles tend to be more rounded abaxially and are sometimes a little longer. The main difference is in the teeth of the fertile pinnule lobes, which in typical ssp. *yaeyamensis* have a minutely erose to subentire apical margin with a tooth at each end, whereas they are protracted and $\pm$ dentiform in the middle in ssp. *merrillii*. This was described and very clearly illustrated by Tagawa (loc. cit.). The sori of ssp. *yaeyamensis* are more often binerval, and the indusia may almost reach the margin. Some of the specimens from Taiwan are very close to ssp. *merrillii*.

JAPAN. Ryukyu: *Ishigaki*, *Nishida* 374 (US); *Kawagoe* s.n. (US); *Fosberg* 37409 (L); *Masamune & Suzuki* s.n. (TAI 6198). Iriomote, *Walker & Tawada* 6733 (BISH, K, L, MICH, US) 6871 (US); *Gressitt* 580 (B, BM, GH, U); *Tagawa & Iwatsuki* 4762 (E, K, L, U); *Masamune* s.n. (TAI); *Oka* 13743 (TOFO); *Bandai* s.n. (TOFO); *Koidzumi* s.n. (US, isotype).

TAIWAN. *Beattie & Kurihara* 10391a (US); *Ogata* 196 (BM); *Tagawa* 955 (BM), 976 (K, paratype); *Henry* 1362 (B); *Simizu* 2789 (TAI); *Hukuyama* 664 (TAI); *Kudo & Mori* s.n. (TAI 6169); *Chuang & Kao* 3409 (TAI, U). Botel Tobago, *Hsu* s.n. (U); *Chuang & Hsu* 2452 (TAI); *Yamamoto* s.n. (TAI 6162). Orchid I., *Sasaki* s.n. (TAI 6161); *Huang & Kao* 7533 (TAI, U).

SECTION *Pseudolancea* Kramer

34. ***Lindsaea oblanceolata*** v.A.v.R. Bull. Jard. Bot. Btzig II. 23 (1916) 15. Type: *Ajoeb* 100, Sumatra (BO; dupl. in L). — *L. pectinata* auct. non Blume; Holttum Rev. Fl. Mal. 2 (1954) 324.

For further synonymy and description see Fl. Mal. (sp. 45).

Distribution. Malesia, East to the Philippines and the Moluccas.

INDO-CHINA. Annam: *Evrard* 1295 (MICH, SING); *Fleury* 38797 (BO).

THAILAND. *Eryl Smith* 1871 (K, SING); *Kerr* 7541 (K), 13287 (K); *Tagawa, Iwatsuki & Fukuoka* T 4781 bis (U); *Smitinand* 875 (K, doubtful).

35. *Lindsaea parasitica* (Roxburgh ex Griffith) Hieronymus Hedwigia 62 (1920) 14; Kramer Blumea 15 (1968) 570. — *Vittaria parasitica* Roxburgh ex Griffith Calc. J. Nat. Hist. 4 (1844) 510. Type: *Roxburgh* s.n. Pulau Penang, Malaya (not seen). — *L. scandens* Hooker Sp. Fil. 1 (1846) 205, pl. 63 B; Beddome Ferns Br. India 2 (1868) pl. 298; id. (1892) 74, fig. 37; Holttum Rev. Fl. Mal. 2 (1954) 325, fig. 186; not of Tardieu-Blot & Christensen Fl. Gén. I. — C. 7 (1939) 121. Lectotype: *Cuming* 405, "Luzon" (K). — *L. lancea* auct. non (L.) Beddome of various authors, as to Asiatic material, at least in part.

For further synonymy and description see Fl. Mal. (sp. 52).

Distribution. Malay Peninsula, Sumatra, Borneo.

THAILAND. v. *Beusekom* 804 (L); *Tagawa, Iwatsuki & Fukuoka* T 5277 (L. U); *Eryl Smith* 780, 1873 (K); *Kerr* 7909 (K).

DOUBTFUL AND INSUFFICIENTLY KNOWN SPECIES

Lindsaea conformis Ching Fl. Reip. Pop. Sin.2 (1959) 372 269. Type: *Tsang* 24950, Kwangtung, China (not seen). — judging from the description this is a form of *L. chienii*.

Lindsaea longipetiolata Ching Sinensia 1 (1930) 51; Bull. Fan Mem. Inst. Biol. Bot. Ser 10 (1940) 174; Fl. Reip. Pop. Sin.2 (1959) 270. Type: *C. C. Chang* s.n., Kiangsi, China (not seen). — This is presumably *L. orbiculata* var. *commixta*.

Lindsaea recedens Ching Fl. Reip. Pop. Sin.2 (1959) 373, 269. Type: *K. L. Ling* 197, Fukien, China (not seen); also reported from Kwangsi and Japan. — The citation of Ito's plate (Ic. Fil. Jap. pl.20) and the description show that this is almost certainly *L. chienii*.

Lindsaea simulans Ching Fl. Reip. Pop. Sin.2 (1959) 371, 265. Type: several syntype collections cited from Kwangsi, Kwangtung, and Yunnan. In the absence of a designated holotype the name is not validly published. One syntype seen: *Lau* 2130 from Kwangtung (MICH), which is *L. orbiculata*.

Lindsaea taiwaniana Ching Fl. Reip. Pop. Sin. 2 (1959) 327, 267. Type: *Hancock* 10; also 128 (paratype), Taiwan (not seen). — Seems to be a form of *L. orbiculata*.

Lindsaea tenera Dryander Trans. Linn. Soc.3 (1797) 42, pl.10; non Kaulfuss 1824, nor of later authors.—*Schizoloma tenerum* (Dryander) Holttum Rev. Fl. Mal. 2 (1954) 348, as to type only. Type: "Habitat in India Orientali: Missionarii Societatis Unitatis Fratrum" (BM).

As stated before, the plants referred by all later authors to *L. tenera* do not match the type (Kramer 1968, where erroneously the name *L. cambodgensis* instead of *L. bouillodii* is adopted for them). The exact provenance of the material being unknown, it seemed that the identity of Dryander's type would remain a puzzle. Then three specimens came to the author's attention that seemed to shed some light on the problem, as they had several important characters in common with the type of *L. tenera*. They are *Kurz* 26016 from the Nicobar Is. (K), *Kurz* s.n. (K) and *Parish* s.n. (E) from the Andaman Is. The differences between this material and what has always been called *L. tenera* (*L. bouillodii* in the present author's concept) may be summed up as follows: petiole stramineous to medium brown (not dark brown), texture thinly herbaceous with very lax venation (not chartaceous with venation of average density), pinnules rounded-rhombic, the incisions of very irregular depth (not rhombic-ovate or dimidiately-ovate and much more regularly incised), the upper pinnules very little incised, with long sori (this is not the case in *L. bouillodii*). The terminal segments are broader and more obtuse than those of *L. bouillodii* in the above-cited specimens but not in Dryander's type.

One of the collectors in the service of the "Societas Unitatis Fratrum" (= Moravian Brothers or Herrenhuters) was Koenig, as stated by Burkill (1965)*. As the Society had contact with the Nicobar Is. at a very early date, Dryander's specimens may very well have been collected by Koenig on that archipelago. As the material at hand is too scanty for a sound judgment of the status of the taxon and its variability, *L. tenera* is here kept among the insufficiently known taxa, although it may well be an endemic taxon, though not necessarily a species, of the Andaman and Nicobar Is.

Lindsaea yunnanensis Ching Fl. Reip. Pop. Sin. 2 (1959) 373, 271. Type: *K. M. Feng* 13646, Yunnan, China (not seen). — The description is unfortunately not accompanied by a figure. This may well be a distinct species, presumably related to *L. bouillodii* and/or *L. chingii*.

Vittaria resecta Roxburgh ex Griffith Calc. J. Nat. Hist. 4 (1844) 510. Type: no specimen cited; said to be "nat. of Chittagong". The extremely brief description is vaguely reminiscent of *L. javanensis* which I saw from nearby Assam. It seems fairly certain that it applies to a species of *Lindsaea*, Roxburgh having described several other, mostly equally obscure species of *Lindsaea* under *Vittaria*.

*I am indebted to Dr. F. M. Jarrett, Kew, for helpful advice and the bibliographic reference pertaining to this problem.

EXCLUDED SPECIES

Lindsaea lanuginosa Wallich ex Hooker Sp. Fil. 1 (1846) 210, pl. 69 B; Beddome Ferns Br. India (1892) 77, etc. = *Nephrolepis acutifolia* (Desv.) Christ.

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